REPORT

OF THE

STATE ROADS COMMISSION

OF

MARYLAND

TRINITY OF TRANSPORTATION—WESTERN MARYLAND RAILWAY, STATE ROAD AND C. & O. CANAL, WASHINGTON COUNTY, MD.

NINTH, TENTH, ELEVENTH AND TWELFTH ANNUAL REPORTS

OF THE

STATE ROADS COMMISSION

FOR THE YEARS

1916, 1917, 1918 and 1919

TO

THE GENERAL ASSEMBLY

OF

MARYLAND

BALTIMORE, MARYLAND
January, 1920

PRESS OF MEYER & THALHEIMER
BALTIMORE, MD.

COMMISSION.

January 1, 1916, to June 1, 1916.

GOVERNOR EMERSON C. HARRINGTON.

O. E. WELLER, *Chairman.*
(Resigned April 22, 1916.)

W. B. MILLER.

ANDREW RAMSAY.

THOMAS PARRAN.

JOHN M. PERRY.

J. FRANK SMITH

FRANK H. ZOUCK, *Assistant Chairman.*
(Succeeded O. E. Weller, April 22, 1916.)

HENRY G. SHIRLEY, *Chief Engineer.*

LEON E. GREENBAUM, *Counsel.*

WILLIAM L. MARCY, *Secretary.*

COMMISSION.

June 1, 1916, to December 31, 1917.

FRANK H. ZOUCK, *Chairman.*

G. CLINTON UHL.

JOHN F. MUDD.

JOHN E. GEORGE, *Assistant Chairman.*

HENRY G. SHIRLEY, *Chief Engineer.*

CLYDE H. WILSON, *Secretary.*

COMMISSION.

January 1, 1918, to December 31, 1919.

FRANK H. ZOUCK, *Chairman.*

G. CLINTON UHL.

JOHN F. MUDD.

JOHN N. MACKALL, *Chief Engineer.*

CLYDE H. WILSON, *Secretary.*

Office of the State Roads Commission of Maryland,
Garrett Building, Baltimore, Maryland.

To His Excellency, Emerson C. Harrington,
Governor of Maryland.

Sir: We have the honor to respectfully submit the following financial report covering the operations of the State Roads Commission of Maryland for the period from December 31, 1915, to December 31, 1919.

Very respectfully yours,

Frank H. Zouck,
G. Clinton Uhl,
John F. Mudd,
State Roads Commission.

Attest:

C. H. Wilson, *Secretary.*

January, 1920.

REPORT OF THE

MARYLAND STATE ROADS COMMISSION

For 1916, 1917, 1918, and 1919

Operations 1916, 1917, 1918 and 1919.

The operations for the first half of 1916 consisted principally of completing the work let in 1915, and looking after maintenance and State Aid work. As the appropriation made by the Legislature of 1914 has been expended or placed under contract in excess of the amount derived from the sale of bonds, no new work was started until after the passage of the appropriation bill by the Legislature and the organization of the new commission on June 1.

On April 22, 1916, Mr. O. E. Weller, chairman, resigned and you appointed assistant chairman Frank H. Zouck to fill out Mr. Weller's unexpired term.

On April 18, 1916, the Legislature passed an act reducing the commission from 7 to 3 members, and on June 1, 1916, Your Excellency appointed Frank H. Zouck as chairman, and G. Clinton Uhl, of Mt. Savage, and John F. Mudd, of Bryantown, members of the commission.

The commission was organized immediately after being appointed, and on June 1, 1916, elected Mr. John E. George, of Sudlersville, Maryland, as assistant chairman, and on July 6, 1916, elected Mr. Clyde H. Wilson, of Hagerstown, Maryland, as secretary.

As soon as the organization was completed, it began to lay out work for the expenditure of the $2,700,000 appropriation made by the Legislature on April 18. The amount of work done in 1916 was greatly curtailed on account of the appropriation not being made until late in April, and as no contracts were let previous to the appropriation being made, it was near the middle or end of the summer before any great amount of work was started. This necessitated quite a large amount being carried over into 1917 uncompleted. During the late winter of 1916, plans were made for filling in all of the gaps in the secondary system, and for the expenditure of the appropriation made by the Legislature.

On April 15, 1918, Henry G. Shirley, who for six years had been chief engineer of the commission, resigned, and was succeeded by John N. Mackall, who had been employed by the commission in various capacities continuously since 1905, except that for one and a-half years prior to his appointment, he had been connected with the Pennsylvania State Highway Department.

The Legislature of 1918 appropriated $3,000,000 for State road construction, but owing to the fact that the country was then engaged in the Great War, no construction work could be successfully carried on, and it was necessary to obtain permission of the War Industries Board before the bonds could be sold, and in order to obtain this permission, the Board had to be convinced that the money which it was proposed to expend would be used only on roads of national importance.

There were, however, a number of uncompleted contracts which were left over from 1917, and which could not be completed because in September, 1918, the drastic Priority Order No. 2 was promulgated, prohibiting the use of open top cars for transportation of materials other than those essential for war work, which prevented the use of this equipment for road building purposes.

It was necessary to arrange to complete these contracts, and when open top cars were again available for road construction, the price of materials, freight and labor had very materially increased, and the commission considered it inadvisable, as well as unfair, to attempt to compel the contractors to proceed with the work taken at low prices, because it would have meant bankruptcy for a number of these, which would further have meant that the bonding companies would have had to complete the work, which would probably have taken two or three years, during which time the public would have been without these roads, and these contractors would have been eliminated from further bidding when it was desirable to ask for further contracts. The commission, therefore, decided to increase the contract prices equal to the increase in prices of labor, materials and freight over those prevailing on the date of the Priority Order No. 2.

These prices could be easily determined, and were satisfactorily determined in all cases, in consequence of which, every contractor proceeded with his work in the spring of 1918, and before fall, every one of these contracts was completed, and the commission felt that their actions in the matter had been fully justified. It is interesting to note that similar actions were taken by other states,

either through their highway departments or through the Legislatures, but Maryland was the pioneer in this.

The excessive war traffic on the Belair-Baltimore-Washington Road, after a very severe winter, caused the road to go to pieces in many places, and it was demonstrated that this road was neither wide nor strong enough to withstand this traffic, and a great deal of effort was put on the strengthening and widening of this road. Certain of these sections on the Washington Road, which had failed entirely, were replaced with concrete 20 feet wide, and all of the macadam was increased by placing a 3-foot wide concrete shoulder on either side, making a total width of 20 feet. This was done practically in accordance with the typical cross section shown in the report to the Governor and the Legislature of 1918. The cost of the widening of this road was paid for from the construction fund, and the cost of repairing and strengthening the original 14 feet of width was charged to maintenance.

In 1919, further sections of the Washington Road, and a section of the road running to Camp Meade, which had been built of concrete of a more or less inferior quality, were resurfaced with standard sheet asphalt pavement, similar to that used on city streets. These sections should give a long life at very low maintenance, and are expected to give extremely satisfactory results. It is also expected that a considerable amount of this kind of resurfacing will be necessary on many of the heavy traffic roads throughout the State.

With the ending of the war in the fall of 1918, a number of contracts were awarded as early in 1919 as the prices of labor and materials had become stabilized, which contracts were satisfactorily prosecuted, and the details as to cost and completion will be found in the accompanying tables.

In addition to the ordinary maintenace of the roads, the commission felt that a number of accidents which occurred annually could be avoided by relatively small expenditures. The first step toward this was the whitewashing of all culvert headwalls, telephone poles and obstructions in close proximity to the line of travel. In consequence of this whitewashing, travel, especially at night, is much more satisfactory, as well as less dangerous.

Dead Man's Curve, on the Washington Boulevard, one half mile south of Elkridge, famous for the number of fatal accidents which happened at this point, was removed by entirely relocating the

road at this point, and which, since its completion, has entirely removed the source of danger.

On the hills on each side of Winter's Run, just south of Belair, where the road was very winding and the grade steep, the banks on the inside of the curves were excavated, and an enbankment three or four feet higher that the road surface formed on the outside, and the road surface banked instead of crowned, which have entirely removed the source of danger at this point. This had been a source of some fatal accidents, and a great number of more or less serious ones.

The commission feels that there are a great number of such places throughout the system which should be removed, and it is their intention to remove them as rapidly as funds are available.

Federal Aid was first obtained on one contract in 1917. In 1918, no further Federal Aid was attempted, owing to the difficulty of construction and restrictions by the government, except the widening and strengthening of the Belair-Washington Road, referred to above; but in 1919, when construction work was again started, practically all State road work was done under Federal Aid.

In the report just issued by the Federal Government, Maryland is one of the three states, which on January 1, 1920, had used its entire Federal Aid allotment. There will be more Federal Aid available July 1, 1920.

CONVICTS.

Convict labor from the Penitentiary was used for the first time in the late summer of 1917 for oiling work, because there was an insufficient supply of free labor to do this work. It takes a gang of about 20 men to spread chips behind a bituminous distributor.

In the summer of 1918, seven gangs, aggregating a maximum of 216 men, were used. These were taken from both the House of Correction and the Penitentiary. Those from the House of Correction were returned daily, while those from the Penitentiary were in some cases returned daily; in others, stationed in permanent camps, and returned to the institution on Saturday nights and brought back to the work on Monday morning; and still others, in local jails at convenient points.

During 1919, seven gangs were used, aggregating 327 men. In 1918, men were used by contractors who obtained their men, and made settlement through the State Roads Commission; whereas

in 1919, a number of contractors used these men, but made their arrangements and settled directly with the Board of Prison Control.

The price charged by the Board of Prison Control to the State Roads Commission and to the contractors was usually a little more than the current rate of local wages, when the cost of transportation, or of housing and feeding was taken into consideration. The reason contractors and the commission were willing to pay a little more than the current rate of wage was because they were assured of a full gang of men at all times, whereas when free labor was used, there was no assurance that the gangs would be full when work began in the morning, and efficiency can only be obtained when full gangs are operating.

The most satisfactory service obtained from the men was from those stationed in local camps, and fed by the contractors themselves. These men were amply and wholesomely fed, housed and well treated, which added to their efficiency. This method also gave the men an opportunity to become experienced in the work, as they remained constantly on the job, whereas the men in the gangs brought back and forth from the institution were often replaced by other less efficient and less experienced men.

Plans and Surveys.

The work of this department has progressed along the lines adopted at the time of its organization in 1912. When making a survey for a proposed road, the Chiefs of Party are instructed to carefully investigate any change of location which would result in improved alignment and grade without prohibitive cost. They make detailed surveys of these locations, and from these notes, plans and estimates are prepared and submitted by the Engineer of Surveys to the Chief Engineer.

During the period covered by this report, a considerable saving in the cost of road construction has been effected by the relocation of existing roads. In St. Mary's County, between Great Mills and Millstone, 75 per cent of the 5.85 miles covered by this contract is a relocation. This resulted in a saving of 0.4 mile in distance, and approximately 1,000 cubic yards of excavation, amounting to about $3,600, and at the same time, bettered the grade of the present road. In Anne Arundel County, between Owensville and Shadyside, the length of the road was decreased approximately 0.8 mile in a distance of 1.5 miles without increasing the maximum per cent. of grade. On the McMullen Highway, in Allegany County, we secured a maximum grade of 6.4 per cent., as compared with

a 12 per cent. on the old road, in addition to an appreciable saving in distance.

One of the most important changes in this department was the adoption of a standard size and scale for all drawings, conforming with the other State Highway Departments and the Bureau of Public Roads. The plans are platted on a scale of one inch equals 50 feet (1″=50′), and the profiles on the same horizontal scale as the plans, with a vertical scale of one inch equals 10 feet (1″=10′). All tracings are twenty-two inches by thirty-six inches (22″x36″). This makes our plans much easier to handle, both in the office and in the field.

The following tables give the number of miles of road surveyed and plans and estimates prepared for the period 1916 to 1919, inclusive. In addition to these, however, in 1917, we made land surveys of the cultivated area of the State Institutions at Rosewood, Springfield, Spring Grove, Cambridge and Crownsville, aggregating about 3,000 acres, and spent several days locating property lines on the addition to the House of Correction farm at Jessups.

SUMMARY OF SURVEYS ON STATE ROADS, 1916-1919.

Year.	Miles of Preliminary Surveys, Including Relocations.	Miles of Reset Stakes, Recross Sections and Work of This Nature.	Miles of Final Surveys.
1916	173.93	58.66	17.51
1917	126.16	39.33	44.65
1918	38.91	3.63	67.82
1919	117.55	47.72	19.76
Totals	456.55	149.34	149.74

SUMMARY OF SURVEYS ON STATE-AIDED ROADS, 1916-1919.

Year.	Miles of Preliminary Surveys, Including Relocations.	Miles of Reset Stakes, Recross Sections and Work of This Nature.	Miles of Final Surveys.
1916	107.68	22.16	56.73
1917	67.14	24.98	58.14
1918	38.35	0.82	30.52
1919	27.73	34.92	8.96
Totals	240.90	82.88	154.35

SUMMARY OF SURVEYS ON ANNAPOLIS BOULEVARD, 1916-1919.

Year.	Miles of Preliminary Surveys, Including Relocations.	Miles of Reset Stakes, Recross Sections and Work of This Nature.	Miles of Final Surveys.
1916	.....	0.75	0.70
1917	.....	.....	1.04
1918	.....	.....	.....
1919	.....	.....	.....
Totals	.....	0.75	1.74

SUMMARY OF SURVEYS ON BALTIMORE-WASHINGTON BOULEVARD, 1916-1919.

Year.	Miles of Preliminary Surveys, Including Relocations.	Miles of Reset Stakes, Recross Sections and Work of This Nature.	Miles of Final Surveys.
1916	.....	.....	.....
1917	.....	.....	.....
1918	.....	.....	.....
1919	0.21	.....	.....
Totals	0.21	.....	.....

TOTAL SUMMARY OF SURVEYS ON STATE ROADS, STATE-AIDED ROADS, ANNAPOLIS BOULEVARD AND BALTIMORE-WASHINGTON BOULEVARD, 1916-1919.

Road.	Miles of Preliminary Surveys, Including Relocations.	Miles of Reset Stakes, Recross Sections and Work of This Nature.	Miles of Final Surveys.	Totals (Miles).
State roads	456.55	149.34	149.74	755.63
State-aided roads	240.90	82.88	154.35	478.13
Annapolis Boulevard	.....	0.75	1.74	2.49
Baltimore - Washington Boulevard	0.21	.....	.....	0.21
Totals	697.66	232.97	305.83	1,236.46

TOTAL SUMMARY OF ESTIMATES, 1916-1919.

Year.	State Roads.		State-Aided Roads.		Annapolis Boulevard.		Baltimore-Washington Boulevard.	
	Actual Miles.	Aggregate Miles of Estimates and Alternate Estimates.	Actual Miles.	Aggregate Miles of Estimates and Alternate Estimates.	Actual Miles.	Aggregate Miles of Estimates and Alternate Estimates.	Actual Miles.	Aggregate Miles of Estimates and Alternate Estimates.
1916.....	157.78	331.06	187.14	436.88	0.76	1.52	.....	.....
1917.....	78.83	133.15	87.26	193.25	.....	.....	.....	.....
1918.....	44.44	44.44	5.27	5.27	.....	.....	22.91	22.91
1919.....	119.22	129.90	78.88	78.88	1.04	1.04	2.73	2.73
Totals.....	400.27	638.55*	358.55	714.28*	1.80	2.56*	25.64	25.64

*Increase in mileage due to the fact that alternate estimates were made on two or more kinds of surfacing on a number of contracts.

TABLE SHOWING PATROLMEN BY YEARS; MILES PATROLLED, AND AVERAGE LENGTH OF SECTION.

Year.	Number of Patrolmen.	Miles Maintained.	Average Number of Miles Maintained per Patrolman.
1908	..	..	..
1909	..	..	..
1910	2	..	..
1911	55	305	5.50
1912	75	374	4.98
1913	107	575	5.37
1914	118	650	5.50
1915	101	600	5.94
1916	185	834	4.50
1917	251	992	3.95
1918	280	1,059	3.78
1919	267	1,086	4.07

(a) MILES OF ROAD COMPLETED AND UNDER MAINTENANCE.

The following table shows the miles of road completed and under maintenance through the State up to January 1, 1920:

Item.	Miles.
Main system outside of Baltimore City	1,341.83
State Aid roads constructed prior to 1916 and not as yet taken over into State system	152.02
Total	1,493.85
Turnpikes purchased, paid for, and under maintenance, but not yet reconstructed	25.00
Total miles	1,518.85

MONEY APPROPRIATED AND RECEIVED TO DATE.

The State Road bonds authorized by the General Assemblies have been disposed of by public sale as provided by the Acts, as follows:

Year Authorized.	Amount of Bonds.	Rate.	Net Proceeds.
1908	$5,000,000	3½%	$4,760,209 76
1910	1,000,000	4%	991,447 55
1912	3,170,000	4%	3,110,432 61
1914	6,600,000	4%	6,514,434 15
1916	2,700,000	4%	2,769,713 21
1918	3,000,000	4½%	3,008,169 84
			$21,154,407 12

NUMBER OF MILES CONSTRUCTED BY YEARS AND AVERAGE COST PER MILE.

Year.	Miles Constructed.	Total Cost.	Average Cost per Mile.
1908	.....	.....	.....
1909	.....	.....	.....
1910	49.96	$533,851 87	$10,685 58
1911	81.68	1,022,592 68	12,519 50
1912	138.99	1,505,941 49	10,834 89
1913	186.04	1,717,902 19	9,234 05
1914	226.85	2,889,340 65	12,736 79
1915	190.98	2,147,440 88	11,244 32
1916	52.12	668,857 10	12,833 02
1917	35.13	423,897 43	12,066 53
1918	59.50	815,448 55	13,705 01
1919	*44.42	908,578 97	20,468 10
Totals	1,065.67	$12,633,851 81	$11,855 31

*There were 115 miles of road under contract January 1, 1920.

OVERHEAD EXPENSES.

The following table gives the percentage of overhead by years in relation to the total expenditures. This table up to December 31, 1915, does not include the overhead for the Baltimore-Washington Boulevard, Baltimore-Annapolis Boulevard, or State Aid construction and maintenance, but for the years 1916 to 1919 it includes all overhead charges.

Year.	Per Cent. of Overhead Expense on Total Expenditures.
1908	
1909	
1910	9.926%
1911	
1912	3.598%
1913	3.478%
1914	3.305%
1915	3.815%
1916	4.966%
1917	3.785%
1918	4.168%
1919	3.548%

AVERAGE MAINTENANCE COST PER MILE PER YEAR.

Year.	
1910 } 1911 }	$279 00
1912	340 00
1913	430 00
1914	372 00
1915	359 00
1916	574 91
1917	712 33
1918	1,067 89
1919	1,091 69

REPORT OF THE CONSTRUCTION AND MAINTENANCE ACTIVITIES 1916-1919.

In order to handle the construction and maintenance work of State roads, the State has been divided into seven sub-divisions or residencies of from two to six counties, each, with a Resident Engineer living at a central point in each residency, responsible for all work therein.

The Cumberland Residency, with headquarters at Cumberland, comprises all of Garrett, Allegany and Washington Counties, and that portion of Frederick County west of Frederick; that is, the National Road from Frederick to the Washington County Line, and the Harpers Ferry Road from Frederick to Weverton, together with all State Aid spurs connecting therewith. The work in this residency is in charge of Mr. L. T. Downey.

The Frederick Residency includes all of Frederick County except the section above described in the Cumberland Residency; all of Carroll County, all of Howard County, except the Baltimore-Washington Boulevard; that portion of Montgomery County lying north and west of a line drawn fron Glenn through the western limits of Rockville to Olney to Snell Bridge; and the Black Rock Road and that portion of the Reisterstown Road west of Reisterstown in Baltimore County. The headquarters of this residency is located in Frederick, in charge of Mr. W. F. Childs, Jr.

The Hyattsville Residency, with Hyattsville as headquarters, comprises those portions of Montgomery and Howard Counties not described as part of the Frederick Residency, all of Prince George's, Charles, St. Mary's and Calvert Counties, and that portion of Anne Arundel County south of Annapolis, including the proposed National Defense Highway from Annapolis to Washington. Mr. R. W. Owens is the Resident Engineer for this section.

The Baltimore City Residency, in charge of Mr. Edwin Friese, comprises all of Baltimore City, and that portion of Anne Arundel County north of Annapolis. The work in this section is directed from the State Roads offices in the Garrett Building, Baltimore.

The Baltimore County Residency includes all of Harford County and all of Baltimore County, except those portions of the Reisterstown and Black Rock Roads included in the Frederick Residency aforementioned. Mr. D. P. Campbell is Resident Engineer of this territory, with the main office of the commission as his headquarters.

The Eastern Shore is divided into two residencies, with headquarters at Chestertown and Salisbury. Mr. A. F. Shure is in charge of the Chestertown Residency, and has Cecil, Kent, Queen Anne's, Talbot and Caroline Counties, except about 660 feet of the Preston-Linchester Road, adjacent to the Dorchester County Line, under his jurisdiction.

The Salisbury Residency includes Dorchester, Somerset, Wicomico and Worcester Counties, and the above-mentioned 660 feet of road in Caroline County near Linchester. Mr. P. E. Burroughs is the engineer in charge.

These limits of the various residencies, which were established early in 1919, have varied from time to time during the period covered by this report, but the relative miles of construction and maintenance have remained in about the same proportion.

A brief resumé of the construction and maintenance activities in these residencies follows:

CUMBERLAND RESIDENCY

By L. T. DOWNEY, *Resident Engineer.*

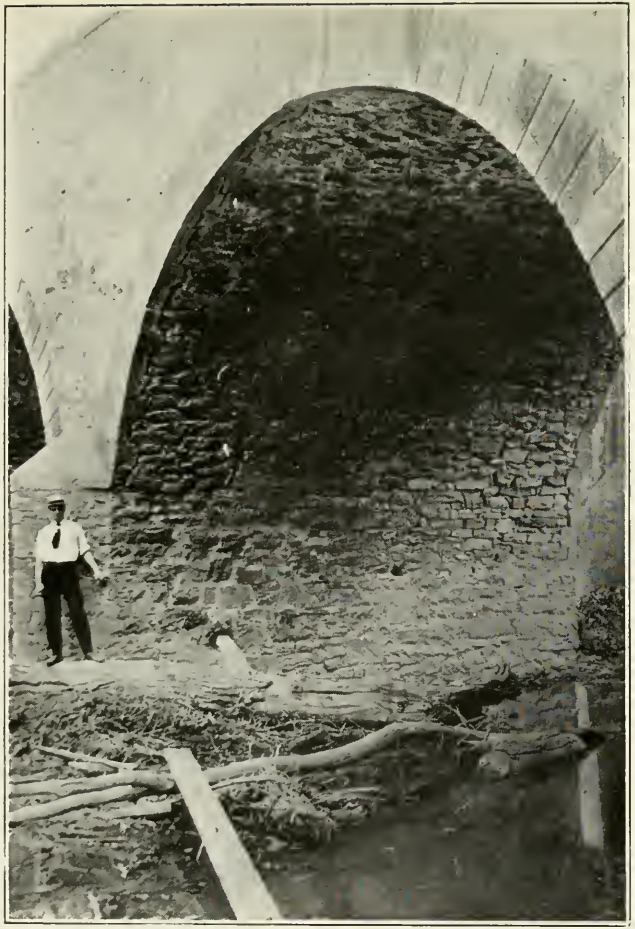
GARRETT COUNTY.

State Road Construction.

During the period of 1916-1919, inclusive, there were no roads completed under the State Roads Act, but there is now building a piece of concrete road under Federal Aid which will make a connecting link between the State of West Virginia and our own. This section of road will be of concrete, 2.12 miles long, 15 feet wide, and eight and six inches thick. It will connect with the West Virginia system at Hutton, West Virginia, and our own system at Oakland. At this writing, all grading has been done,

VIEW OF CONCRETE ROAD ON THE NATIONAL PIKE, THROUGH LA VALE, ALLEGANY COUNTY.

VIEW OF GENERAL MAINTENANCE ON BALTIMORE PIKE, IN ALLEGANY COUNTY, EAST OF CUMBERLAND.



VIEWS OF STONE ARCH BRIDGE OVER ANTIETAM CREEK, NEAR MILLPOINT, IN WASHINGTON COUNTY, BEFORE AND AFTER REPAIRING WITH A CEMENT GUN.

VIEW OF FIFTY-FOOT CUT ON McMULLEN HIGHWAY, IN ALLEGANY COUNTY.
LOOKING EAST FROM STATION No. 46.

VIEW SHOWING FORTY-FOOT FILL, CONCRETE CULVERT AND BEGINNING OF CONCRETE ROADWAY ON McMULLEN HIGHWAY, IN ALLEGANY COUNTY.
LOOKING WEST FROM STATION No. 46.

and concrete partly so. It is expected that this road will be finished by the middle of July, 1920.

State Aid Construction.

State Aid activities for the period of 1916-1919, inclusive, have been very slow, consisting of only two small sections of six-tenths of a mile each, one being finished in the fall of 1916, and the other in the fall of 1917. These small sections connect with the main line road at Weber's Corner, and from that point go through Mountain Lake Park to the Baltimore & Ohio Station at same point. These pieces will form part of a system which some day will include Deer Park, and other small towns in Garrett to the south of Oakland.

Maintenance.

There are 58.6 miles of Road under State Maintenance, of which number 2.8 miles are concrete, through Accident, 15.5 miles asphaltic macadam of sand and stone, 32.3 miles limestone macadam and eight miles of sand stone macadam. This includes 5.6 miles between Oakland, Mountain Lake Park and Gortner, built as State Aid. All macadam has had surface treatment each year with exception of the asphaltic, which has had two treatments in four years, and 14 miles of limestone macadam omitted from oiling in 1918. About 1,500 feet of roadway have been resurfaced, same being done this season. All of these roads are in the mountainous section, and have patrolmen, the average section being about four miles. Surface is generally good, but about six miles are 10 years old, and will soon need resurfacing or replacing with concrete. On account of hills, it has been the custom to stone shoulders, and this is being done each season by the patrolmen, and in this way substantial shoulders that will withstand the steel tire traffic are being obtained.

Allegany County.

State Road Construction.

Under the State Roads Acts there has been built for the period 1916-1919, inclusive, 14.9 miles of road, of which nine miles is oil-bound macadam, and 5.9 water-bound macadam. The completion of seven miles of the above during the past season, closed the gap in the main line going west from Baltimore to the Pennsylvania State Line and to Oakland. The above mileage consists of 12 feet wide, six inches thick macadam built of local stone and completed, 7.9

miles in 1916, and seven miles in 1919. These sections go over Town Hill Mountain, Green Ridge Mountain, and Polish Mountain, and are noted for their scenic beauty.

During the summer of 1917, there was constructed a modern concrete bridge over Fifteen Mile Creek. The new bridge did away with an old wooden structure which had dangerous approaches and narrow width, and was becoming unsafe for heavy traffic. The new bridge has a clear span of 70 feet, with a superstructure carried on arch rings which are models of their kind. Total length of bridge is 110 feet, and there is a clear width of 22 feet.

During the past season, two pieces of Federal Aid work were started, the McMullen Highway, 3.9 miles of 18 feet wide, eight and six-inch concrete, and the Ellerslie Road, 2.3 miles of 15 feet wide, eight and six-inch concrete. The latter road is nearing completion, and will be a connecting link with the Pennsylvania system. The McMullen Highway, which is being paid for in part from State Aid funds, will connect Cumberland with Cresaptown finally, but at the present time extends only to the new plant of the American Cellulose Company. This road has given a great boom to real estate development in outlying Cumberland sections. It is expected that road will be finished by July, 1920.

State Aid Construction.

There was built under State Aid Acts during period of 1916-1919, inclusive, 3.7 miles of road, of which 1.5 miles is 12 feet wide, six-inch concrete, 1.6 miles 12 feet wide, eight-inch water-bound macadam, and 0.6 mile of 14 feet wide, six-inch concrete. The first two sections are links in what is known as the Legislative Road, connecting Frostburg and Westernport with all the mining towns on Georges Creek. The third section, known as Bedford Road, forms a connecting link with what will some day be a part of the Pennsylvania system. All of the above are now under State maintenance, same having been accepted by State upon their completion. The county during the past season, in addition to the McMullen Highway referred to above, was engaged in building the last link in the Legislative Road, but was unable to finish it this year. It is expected that this road will be completed by July, 1920.

Maintenance.

There are now under State maintenance 39.3 miles of originally built State roadway, of which 3.4 miles is 14 feet wide, seven and

five-inch concrete, the remainder all being water-bound limestone macadam, surface treated. With the exception of the past season, all of the macadam has had surface treatment each season during period of 1916-1919. This past season 2.7 miles were omitted. During 1917, one section of 2,000 feet was resurfaced in the Narrows on National Pike, and this past season saw about one-half mile resurfaced. The roads in the county are among the oldest in the State. All roads are in good condition generally. Patrolmen have average sections of about four miles. Shoulder maintenance on hills are the greatest source of cost. The hills are being stoned to reduce shoulder maintenance.

There are now under State maintenance 33.7 miles of former State Aid roads. Of this amount, 6.8 miles are concrete, the remainder being water-bound macadam, surface treated. Roads have received surface treatment each year with the exception of 1919, when three miles were omitted. Roads are in good shape generally.

Washington County.

State Road Construction.

From 1916-1919, inclusive, there has been built only one piece of road under the State Roads Act in Washington County. This piece of road is of concrete from 16 to 27 feet wide, and five and seven inches thick, and goes through the town of Funkstown. This forms one of the connecting links of the main line west from Baltimore.

Only one piece of roadway has been undertaken in Washington County under the Federal Aid Act during the period of 1916-1919. This piece of road forms the connecting link with West Virginia at Harpers Ferry, and is of concrete 3.5 miles in length, 15 feet wide, and six and eight inches thick, 0.7 mile of which is in Frederick County. This road was under construction during the past summer, and is now nearing completion, and will probably be finished by the first of the year.

State Aid Construction.

The activities in the State Aid road building in Washington County for the period of 1916-1919, inclusive, consist in the building of 14.3 miles of limestone macadam road as follows:

Saint Paul's Church Road, 1.9 miles, nine feet wide, eight inches thick; Big Pool Road, two miles long, 12 feet wide, eight inches thick; the Downsville Road, 2.4 miles long, nine feet wide, eight inches thick; Cearfoss Road, one mile long, nine feet wide, eight inches thick; the Smithsburg Road, 4.6 miles long, 10 feet wide, eight inches thick; the Fiddlesburg Road, 1.1 miles long, nine feet wide, eight inches thick; Chewsville Road, 1.3 miles long, nine feet wide, eight inches thick. All of these roads, with the exception of the Cearfoss Road were finished in 1916, and all of them, with the exception of the Cearfoss Road, have been taken over by the State Roads Commission, and are now being maintained as State Roads. The Smithsburg Road was resurfaced this past season in order to put it in an acceptable condition for the State Roads Commission. The other roads were taken over upon their completion.

There are under construction at this time, under the State Aid Act, 6.2 miles of road, of which 1.6 miles is of concrete, 15 feet wide, and eight and six inches thick. This piece of road is a connecting link between the Baltimore Pike at Hancock, and the Pennsylvania system which connects with the Lincoln Highway. This road will be finished about July, 1920. Another piece of concrete road 14 feet wide, and seven and five inches thick, is being built from McLaughlin's School House towards the Pennsylvania State Line. The third piece of road, from Lappans to Millpoint, 3.6 miles, is of water-bound macadam, 12 feet wide and eight inches thick. It is expected that this road will be completed in the early spring.

Maintenance.

There are now under State Roads maintenance 43.6 miles of roads, of which 1.7 miles are concrete; the remainder being water-bound macadam built of local limestone and afterwards surface treated with tars and asphalt. All of these roads were surface treated in 1916, 39.6 treated in 1917, 30.6 in 1918, and 34.6 in 1919. A small amount of resurfacing was done during the season of 1919, and some similar work was done in 1918 near Boonsboro. The surface is in good shape today and is being maintained by the patrolmen. During the past season 10 miles of shoulders were stoned, and one very bad curve at Conococheague Hill was widened out, banked and had a large stone retaining wall built on the outer edge of curve, so as to safeguard traffic. The patrolmen have an average section of about four miles each.

Frederick County, West of Frederick.

State Road Construction.

The State Roads System in Frederick County, west of Frederick, was completed previous to the period of 1916-1919, with the exception of 0.7 mile between Knoxville and Harpers Ferry, which forms part of the Washington County contract above referred to, and which was completed in 1919.

State Aid Construction.

During the period of 1916-1919, inclusive, two pieces of State Aid road have been built in Frederick County in this residency. They are the Brunswick-Petersville Road, 2.9 miles in length, forming a connecting link between the State Road from Frederick to Harpers Ferry and Brunswick, Maryland, and the Burkittsville-Knoxville Road, 1.2 miles in length. Both are of limestone macadam, 14 feet wide and eight inches thick, and were finished in 1916.

Maintenance.

In Frederick County, in this residency there are 31.1 miles of road under State maintenance. All of these roads are of water-bound macadam, surface treated, and have had the surface treatment each season, with the exception of 1919, when only 12.3 miles of road were given a surface treatment. These roads are in good shape generally, and are kept so by seven patrolmen, who have an average section of about 4½ miles each. During the past season about 1½ miles of shoulders were stoned west of Frederick. Next season it is hoped that this will be continued on this road and started on the Jefferson Pike, where material for shoulders is getting somewhat scarce. At the top of Braddock Heights, on the main line west of Frederick, a large stone wall was built on the outside of the curve, so as to protect the traveling public. This curve has been the scene of several accidents (none fatal) in the past, but since the erection of a wall no accidents have been reported as having occurred at this point.

FREDERICK RESIDENCY.

By W. F. CHILDS, JR., *Resident Engineer.*

FREDERICK COUNTY.

State Road Construction.

There have been built in Frederick County a total of 13.40 miles of State Highways during the past four years, 7.46 miles being macadam and 5.94 miles concrete. Of this total mileage, 8.34 miles were built on the Emmitsburg Pike, making a through road from Frederick to the Pennsylvania State Line; 3.25 miles of the gap between Emmitsburg and Bridgeport were completed, and 2.01 miles of concrete road were built in 1918 and 1919 on the Buckeystown Road, from Buckeystown towards the Montgomery County Line. The latter road was built under Federal Aid.

There are under construction the following roads in Frederick County: Urbana Road, 1.79 miles of 15-foot, six and eight-inch concrete; Emmitsburg to Bridgeport Road, 1.86 miles of 15-foot, six and eight-inch concrete; Buckeystown Road, 1.96 miles of 15-foot, six and eight-inch concrete; making a total of 5.61 miles.

On the Urbana Road, the work is confined to grading and drainage only, and to date it is 15 per cent. complete; on the Emmitsburg-Bridgeport Road, the grading is 90 per cent. complete, and the surfacing 60 per cent. complete, there having been laid to date one mile of surfacing; on the Buckeystown Road the grading is 12 per cent. complete, and approximately one-tenth of a mile of surfacing has been laid.

On all of these roads, we are receiving Federal Aid in the construction of same.

State Aid Construction.

In 1916, a contract for 1.5 miles of Amiesite paving was awarded on the Monrovia-Hyattstown Road, but the contractor failed after completing the base course, and no topping has been put down as yet. This will probably be done in 1920. At the present time, there is under construction 4.38 miles of 14-foot concrete roadway between Lewistown and Creagerstown. To date there has been laid but 0.55 mile of surfacing and the grading is approximately 25 per cent. complete.

Maintenance.

There are some 48.07 miles of road under State maintenance in this section of Frederick County, being classified as 42.10 miles of macadam and 5.97 miles of concrete. The maintenance is cared for by eight patrolmen and three floating gangs. The costliest maintenance is on the Frederick Pike, over which the traffic is very heavy and annual repairs in accordance. After the severe winter of 1917-1918, considerable resurfacing was made necessary during the summer of 1918; however, in no case has this amounted to reconstruction.

At the present time, one mile of a three-inch concrete shoulder is being built on the north side of the Baltimore-Frederick Pike, immediately east of Frederick. These shoulders have not only an advantage in increasing the width of the road, but at the same time flattens the crown, making the road less dangerous to all traffic in general, and horse-drawn traffic in particular.

An extensive schedule for widening out and banking the curves on the Frederick Pike had been formulated, but had to be abandoned on acount of lack of funds.

The Monrovia-Hyattstown State Aid Road has been inspected with a view to placing same in a satisfactory condition for State acceptance. County forces are now at work on these repairs, and when completed this will add 1.50 miles of 12-foot macadam road to the State's system.

During the period covered by this report, the following roads have been surface treated with oil and stone:

In 1916, 32.40 miles, using 72,624 gallons of Tarvia "B"; in 1917, 28.06 miles, using 70,741 gallons of Pontar; in 1918, 41.33 miles, using 84,870 gallons of Tarvia "B," and in 1919, 47.87 miles, using 76,970 gallons of asphalt and 22,500 gallons of Tarvia "B."

The two wooden deck bridges on the Emmitsburg Pike immediately north of Lewistown, were improved the past fall by the building of new floors.

Carroll County.

State Road Construction.

Between 1916 and 1919, there have been built under the State Roads Act some 6.8 miles of modern highways, completing important gaps on the main arterial system between Westminster and Manchester, Westminster and Emmitsburg, and Westminster

and Sykesville, with the exception of 3.14 miles of 14-foot concrete roadway between Taneytown and Bridgeport, and type of construction has been confined to reconstructing old pikes with water-bound macadam, which were oiled immediately after completion.

The following roads are now under construction in this county: Littlestown Pike, from Westminster to Union Mills, four miles of 16 foot, six and eight-inch concrete; Westminster to New Windsor, one mile of 15-foot, six and eight-inch concrete.

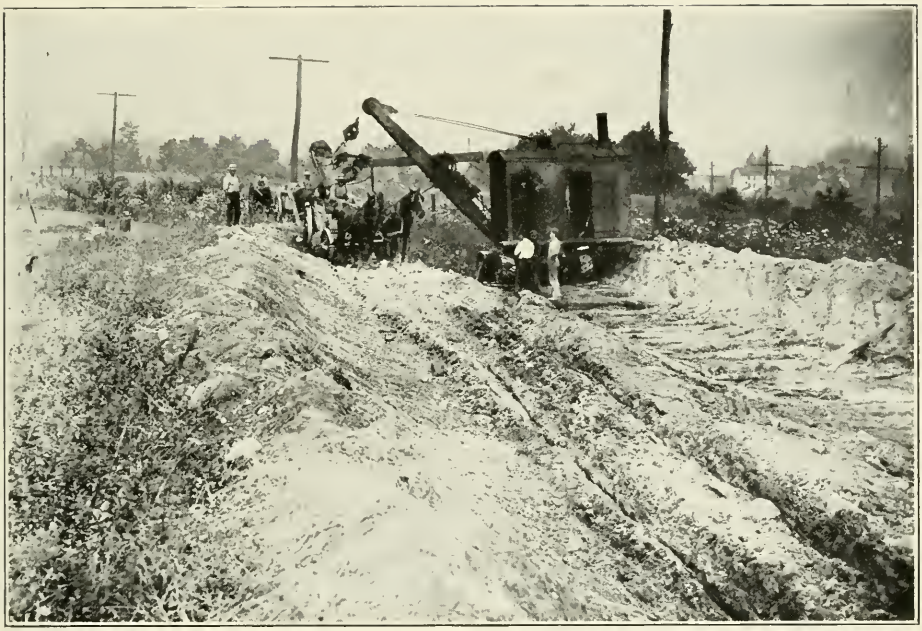
The first-named route has been practically completed. On the New Windsor Road, the grading has been completed, and drainage structures built, but owing to the lateness of the season, no surfacing will be laid this year.

State Aid Construction.

During the seasons of 1916, 1917 and 1918, the Reisterstown-Westminster Turnpike, 8.7 miles in length, was built under the State Aid Act, and immediately upon completion, taken over for State maintenance. A 64-foot concrete arch bridge was also built across the Patapsco River at Woodbine in 1917, Howard County sharing equally in the cost thereof. There are several sections of this type of road under construction at the present time as follows: Beckleysville Road, 0.55 mile, 15-foot, six and eight-inch concrete; Oakland Mills Road, 1.67 miles, 15-foot, six and eight-inch concrete; Main Street of Mt. Airy and Ridge Road, 1.52 miles, 15-foot, six and eight-inch concrete; Littlestown Pike, from Union Mills north, 6.62 miles, 16-foot, six and eight-inch concrete, and the New Windsor Road, 1.08 miles, 15-foot, six and eight-inch concrete, making a total of 11.44 miles.

On the Beckleysville Road, the grading has been completed, drainage structures built, and about 50 per cent. of the surfacing laid to date. This road will not be completed this year. On the Oakland Mills Road, all but approximately one-quarter of a mile of the surfacing will be completed this year. The Main Street of Mt. Airy, and the Ridge Road, will be completed and opened to traffic this year. On the Littlestown Pike, two miles of the 6.62 miles of road under contract have been completed on the Union Mills end, which makes a total of six miles of improved road constructed on this pike this year.

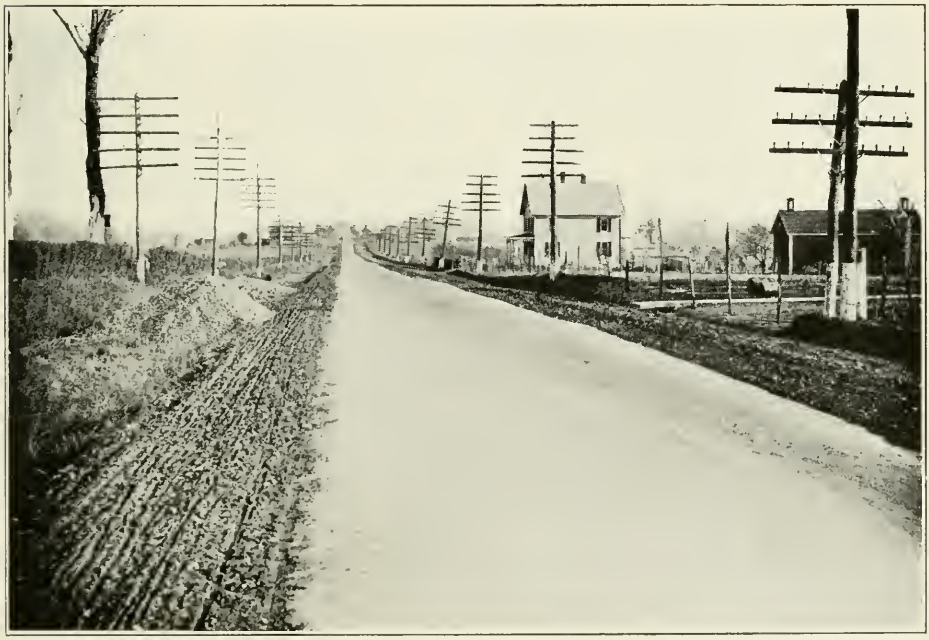
The work on the New Windsor Road has been confined solely to grading and building of drainage structures. No surfacing will be laid on this contract this year.



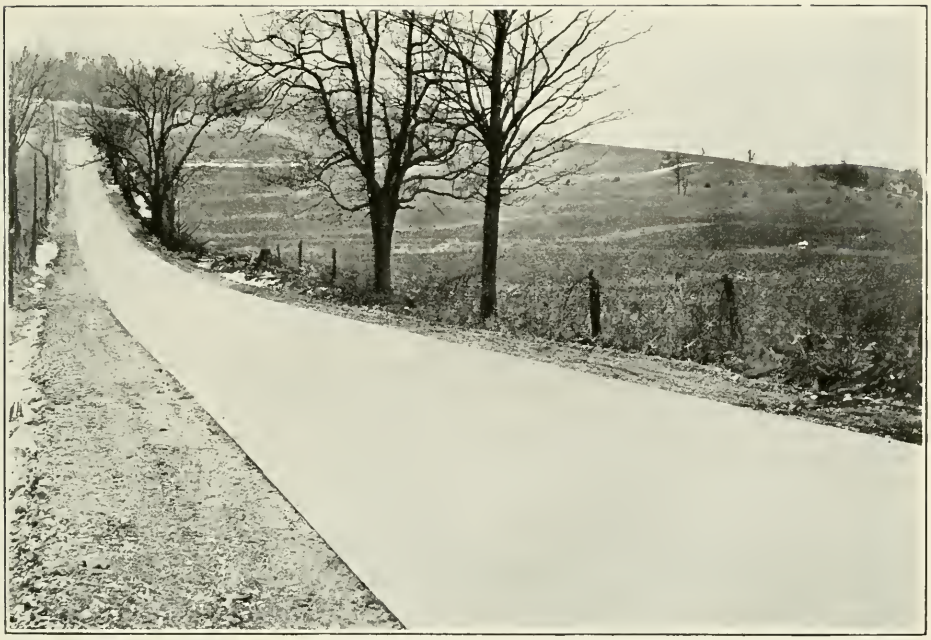
VIEW SHOWING STEAM SHOVEL AT WORK GRADING RELOCATION OF URBANA TURNPIKE, IN FREDERICK COUNTY.

VIEW OF CONCRETE ROAD BETWEEN WEVERTON AND KNOXVILLE, IN FREDERICK COUNTY, THE FINAL LINK IN THE STATE ROAD SYSTEM BETWEEN BALTIMORE AND HARPER'S FERRY, W. VA.

FREDERICK ROAD, IN FREDERICK COUNTY, SHOWING GENERAL MAINTENANCE. STONED SHOULDERS ON EACH SIDE.



VIEW OF GENERAL MAINTENANCE ON THE FREDERICK ROAD, IN FREDERICK COUNTY. NOTE STONED SHOULDERS.



CONCRETE ROADWAY ON LITTLESTOWN TURNPIKE, IN CARROLL COUNTY.

VIEW OF GENERAL MAINTENANCE ON MANCHESTER ROAD, IN CARROLL COUNTY.

VIEW OF GENERAL MAINTENANCE ON FREDERICK ROAD, IN HOWARD COUNTY.

Maintenance.

Including 19 miles of road built under the Shoemaker Act, and taken over by the State, there is under State maintenance in Carroll County, a total of 65.18 miles of modern roads, classified as follows:

Fourteen-foot concrete and bituminous concrete, five and seven inches thick, 11.39 miles; 16-foot concrete, six and eight inches thick, four miles; 12-foot macadam, eight inches thick, 5.94 miles, and 14-foot macadam, eight inches thick, 43.85 miles.

The maintenance in this county is in charge of 12 patrolmen and four gangs. During the summer of 1918, extensive resurfacing was done on the Reisterstown Road and on the Meadow Branch Pike. During 1919, the two miles of the Meadow Branch Pike from Westminster west, were resurfaced with macadam by State forces, and this road is now in excellent condition. Also, in 1919, it was necessary to make some extensive repairs to the roads at Houcksville, New Windsor and Middleburg. These roads were built under the Shoemaker Act, and prior to this season, practically nothing had been done towards the maintenance of same, since they were taken over by the State. Also, considerable work was done in widening out and grading the shoulders on the Washington Pike and the Westminster-Reisterstown Road. As a whole, these roads are now in a very good state of repair.

On the Littlestown Pike, the five-stone arch bridge at Union Mills was repointed, repaired and new copings built by the State out of the maintenance fund at a cost of approximately $4,000.

During the summer of 1919, 1,700 linear feet of concrete shoulder and gutter were built on the east side of the Sam's Creek Road from Woodbine north. This is a great improvement to the roadway, and will effectively reduce the future cost of maintenance of this particular piece of road, by preventing washouts on the shoulders.

The surface treatment of roads in this county by years follows: In 1916, 27.82 miles, using 51,579 gallons Tarvia "B" and 17,375 gallons Ugite "B"; in 1917, 20 miles, using 37,707 gallons of Pontar and 5,437 gallons of Axtec; in 1918, 40.34 miles, using 80,625 gallons Tarvia "B," and in 1919, 48.47 miles, using 101,355 gallons asphalt.

Three wooden-deck bridges in Carroll County have been made safe to travel during the past season by the building of new floors on the bridge between Taneytown and Frizzleburg; on that over

Morgan Run on the West Friendship Road, and on the bridge on the North Branch Road.

BALTIMORE COUNTY.

State Road Construction.

During the four years covered by this report, the State Highway construction in that section of Baltimore County included in this residency, has been confined to the building of the gap on the Baltimore-Westminster Pike for a distance of 2.55 miles, from Reisterstown to the Carroll County Line. This road was completed in 1918, and consists of 0.47 mile of 16-foot Amiesite paving; 1.93 miles of 16-foot oil-bound macadam, and 0.15 mile of 16-foot concrete, seven and five inches thick.

State Aid Construction.

There has been no construction of State Aid Roads in this section of Baltimore County during the period covered by this report.

Maintenance.

The total mileage of State Roads under maintenance in this portion of Baltimore County is 6.90, including some 4.35 miles of road built under the Shoemaker Act, and taken over by the State for maintenance in 1919.

With the exception of some extensive repairs on the Reisterstown Road in 1918, the maintenance of these roads has been taken care of by one small gang and two patrolmen. During 1919, a repair gang has been at work resurfacing the Black Rock Road mostly all summer, and this work has just recently been completed in a satisfactory condition.

In 1916, one mile of road was surface treated; three miles in 1917; 3.44 miles in 1918, and 6.55 miles in 1919. Prior to the season of 1919, tar was used in the surface treatment of these roads, while in 1919, asphalt was used and excellent results obtained. At the present time, these roads are in a very good state of repair.

HOWARD COUNTY.

State Road Construction.

The only pieces of highway built under the State Road Act between 1916 and 1919 were the Columbia Turnpike from Ellicott

City to Columbia, 2.26 miles in length, of 14-foot macadam, and the 2.10 miles of 15-foot concrete road on the Clarksville Pike, between Clarksville and Snell's Bridge, which was completed in 1918. The original contract contemplated building the entire gap from Clarksville to Snell's Bridge, a total of 4.6 miles, but owing to labor trouble and the condition of the material market, induced by the war, it was not practical to complete but 2.10 miles of this road. Approximately 1.3 miles were built on the Snell's Bridge end of the gap, and 0.80 mile on the gap north of Clarksville, leaving a section of uncompleted roadway between Clarksville and Highland of approximately 2.50 miles. This section is now under construction, and to date all grading has been completed between Clarksville and Highland and 1.55 miles of surfacing have been laid, leaving one mile north of Highland that will not be closed in this season.

Also, the remaining gap between Clarksville and Elioak is under construction, but owing to adverse weather conditions and labor trouble this will not be completed this year. Concrete surfacing will be laid, however, over the steep grades north and south of the Bridge at Middle River for a distance of approximately one-half mile before the work is discontinued this winter.

State Aid Construction.

The construction of State Aid roads in this county was confined during this period to the building of the Woodbine-Lisbon Road, connecting the town of Woodbine with the Frederick Pike. This consists of 1.74 miles of 14-foot concrete roadway and was built in 1916, and accepted by the State for maintenance immediately upon completion. One-half of the cost of the 64-foot concrete arch bridge across the Patapsco River at Woodbine, built in 1917, was also borne by Howard County.

There is under construction 3.77 miles of State Aid road, known as the Mikes Quarter Road, which taps the Frederick Pike at a point approximately six miles west of Ellicott City. The contract for building this piece of road was awarded the Amiesite and Stone Company in 1916, and construction was carried on in 1917, but owing to abnormal conditions brought about by the war, the road was not completed during that season, but operations were continued in 1918. Early in 1919 the work was resumed, when a strenuous effort was made to organize sufficient forces to push

it to completion this year. Owing to the failure of the Amiesite and Stone Company, the construction of this work was taken over by the bondsman, and the character of the road was changed from Amiesite paving to sheet asphalt on a stone base. At the present time the grading has been completed over the whole road, the base built on one-half the length of the road, and asphalt laid for one-quarter of a mile. While every possible effort is being made to complete the road this year, it is very doubtful that this will be accomplished.

Maintenance.

Including 4.69 miles of State Aid road taken over by the State, there is under maintenance some 37.87 miles of highways in Howard County, including 36.13 miles of macadam and 1.74 miles of concrete.

Eight patrolmen and one floating gang have been sufficient to care for this work. Except for resurfacing a section of the Frederick Pike, west of Ellicott City, in 1918 and 1919, no extraordinary repairs have been necessary. Considerable work has been done to the shoulders of the Frederick Pike, between Ellicott City and Ridgeville, in the way of widening out and bringing same up to the proper cross-section. Wherever practical, this work has been accomplished by the use of machinery.

Inspection has been made on 0.88 miles of the Locust Chapel State Aid road, and 2.35 miles of the St. John's Lane State Aid road, with a view of placing same in condition for acceptance by the State. County forces are now at work on the latter road, but the repairs will not be completed this season.

The roads that have been surface treated with oil and stone during the past four years are as follows:

In 1916, 28.84 miles, using 61,083 gallons of Tarvia "B"; in 1917, 25.87 miles, using 63,730 gallons of Pontar; in 1918, 31.09 miles, using 67,233 gallons of Tarvia "B"; and in 1919, 34.04 miles, using 74,234 gallons of asphalt.

The bridge on the Frederick Pike, about three miles west of Ellicott City, was improved the past fall by building a longitudinal floor on top of the old decking.

MONTGOMERY COUNTY.

State Road Construction.

In the section of Montgomery County included in this residency there have been built but 1.70 miles of oil-bound macadam, 14 feet wide, between Dawsonville and Lee's Corner. The work was started in 1916 and completed in 1917. This leaves an unfinished gap of approximately one-half mile over Seneca Creek, which is in a very bad state of repair and is a constant source of expense to the State. This gap should be built in order to complete the main highway between Rockville and Lee's Corner.

State Aid Construction.

The only piece of State Aid road built during the period covered by this report was 4.32 miles of 12-foot oil-bound macadam, between Dawsonville and Poolesville. This road was built of local sandstone. The grading was started in the fall of 1916, and construction was carried on through 1917, and the road completed and opened to traffic in 1918, thereby connecting Poolesville and Washington by a modern highway.

Maintenance.

Including 16.04 miles of State Aid roads taken over by the State in 1917 and 1918, there is under maintenance in this section of Montgomery County a total of 47.73 miles of State Highways, including 38 miles of macadam and 9.73 miles of concrete. This maintenance is in charge of 10 regular patrolmen and one floating gang.

During 1917 extensive maintenance work was done on the Boyds-Burdette Road, which was made necessary by a cloudburst, which was particularly destructive in this section of the county. Again in 1919 it was necessary to place a gang on this same piece of road to do extensive repairs to the shoulders. The work in 1919 included paving the shoulders with stone and treating same with oil and chips in order to prevent further washes. During the summer of 1916 one and one-half miles of the Rockville Road, between Westmore Station and Gaithersburg, were resurfaced with No. 2 stone. During 1919 the maintenance work on this particular road was very light, and it is in very good condition at the present time.

During 1919 considerable resurfacing work was done on the Laytonsville Road, and the shoulders were filled in with stone for practically its entire length. This work was very timely and the road is now in a very good state of repair.

Considerable maintenance work has been done on the gap at Seneca Creek, in order to keep it in a passably good condition. A gang is now at work on this piece of uncompleted road in an attempt to make it passable during the winter. Local gravel and stone are being used in connection with this repair work.

The surface treatment of the roads in Montgomery County by years was as follows: In 1916, 17 miles, using 42,549 gallons of Ugite "B"; in 1917, 20.24 miles, using 39,303 gallons Ugite "B," 6,971 gallons Pontar and 4,800 gallons of Axtec; in 1918, 16.66 miles, using 34,207 gallons of Ugite "B"; and in 1919, 23.18 miles, using 43,219 gallons of asphalt.

During the past season a new timber decking was placed on the bridge on the Buck Lodge Road, near Buck Lodge Station. At the present time new lumber is being hauled with which to redeck the bridge over Seneca Creek, near Dawsonville.

HYATTSVILLE RESIDENCY.

By R. W. OWENS, *Resident Engineer.*

MONTGOMERY COUNTY.

State Road Construction.

In the section of this county south of a line from the northernmost limits of Rockville to Snell's Bridge:

During the period of 1916 to 1919 there have been three sections of road completed. About 5½ miles from Olney to Snell's Bridge, tar-bound macadam, 14 feet wide; 1½ miles of the Seventh Street Pike, near Olney, water-bound macadam; and the road through Rockville, nearly two miles, built of concrete.

State Aid Construction.

The only State Aid road constructed during this period was from Colesville to the Seventh Street Pike, a distance of 3½ miles.

Maintenance.

Under maintenance about 1½ miles of the road from Rockville to Norbeck, which was built of flint with a clay binder, was surfaced with limestone.

The roads in this section of Montgomery County were treated annually with tar.

We have taken over for maintenance about 16½ miles of State Aid roads in this section of this county. Due to the proximity to Washington and the high rate of wage the Government is paying, it has been almost impossible to secure efficient help at reasonable prices; therefore, the work of maintaining this section has been rendered extremely difficult. In addition to the State Aid roads, we have two miles of concrete road, 17 miles of water-bound macadam and five miles of tar-bound macadam.

Prince George's County.

State Road Construction.

In Prince George's County during the period of 1916 to 1919 there were two roads built under contracts with the State Roads Commission; 3½ miles of concrete from Camp Springs to Meadows, and one mile through Marlboro.

One section of concrete road, 1½ miles in length, from Bladensburg toward Lanham; a section of the so-called National Defense Highway; and a 16-foot one-course concrete roadway on which grading only has been done.

Another section under construction, also about 1½ miles in length, runs from Largo toward Hall's Station. On this the grading has been completed and about 1,200 linear feet of concrete surfacing have been laid. This road is 15 feet wide.

State Aid Construction.

During this period there were three State Aid roads constructed, all of concrete; one known as the Sargent Road, starting at the District Line and running one mile toward Chillum; a section through Riggs' Mill, and a section through Cottage City; each of these sections being about one mile in length.

Maintenance.

Three bridges at Marlboro were taken over for maintenance, and about four miles of old State Aid road. Nineteen and one half miles of road were treated with tar, and all sections maintained by patrolmen.

There are 47½ miles of road to be maintained in Prince George's County, exclusive of the Baltimore-Washington Boulevard; 38½ miles built under contract with the State Roads Commission, and seven miles of State Aid road, which have been taken over. Of these, 4½ miles are of Amiesite; 7½ miles of gravel macadam treated with tar; nine miles of stone macadam, and 24½ miles of concrete.

CHARLES COUNTY.

State Road Construction.

Six projects were started in the above county during the period 1916-1919, all of eight-inch gravel macadam; three of which were completed. The contracts for the other three sections were not let until late in the fall of 1919, and nothing has been done thereon.

The remaining link between La Plata and Indian Head, 5½ miles in length; Ripley to Mason's Springs; a section of road through La Plata, one-half mile long, connecting the road from Mattawoman to La Plata with the road from La Plata to Rock Point; also a section from La Plata to Rock Point, were constructed between 1916 and 1919.

Two old bridges between Waldorf and Bryantown were replaced with concrete structures.

State Aid Construction.

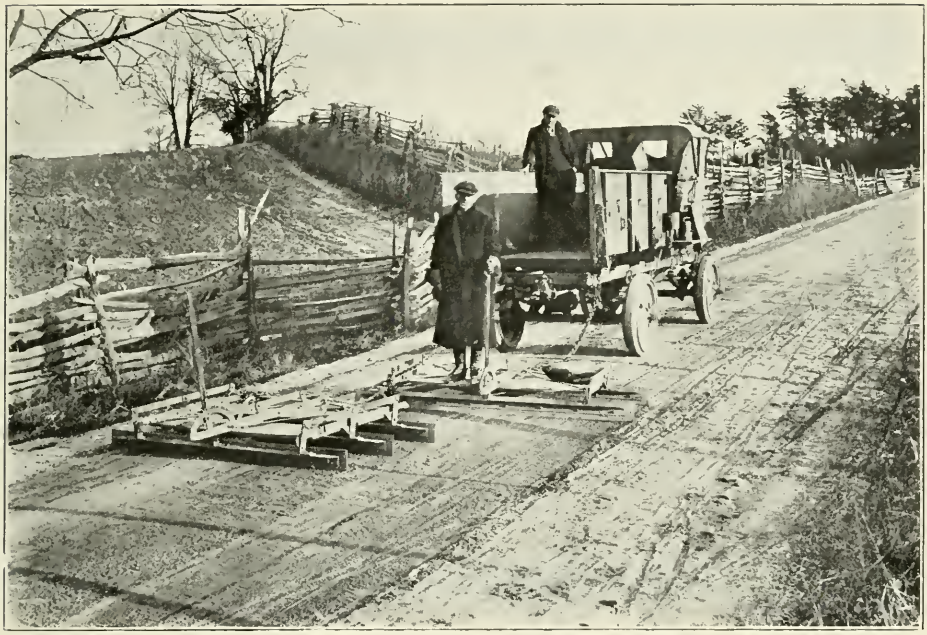
The period covered by this report marked the beginning and partial construction of an improved road toward Riverside. About five miles of this have been completed, and 10 miles are under contract.

Maintenance.

There are in Charles County 44½ miles of untreated gravel roads, 10½ miles of gravel roads which have been treated with tar annually, and five miles of concrete road with a width of nine feet.

Maintenance on the gravel section has become costly, owing to increased prices of labor and the vast amount of passenger, bus and freight truck traffic. The gravel roads are maintained by patrolmen, who are provided with drags, which are used whenever possible.

TWENTY-FOOT CONCRETE ROAD ON BALTIMORE AND WASHINGTON BOULEVARD, IN HOWARD COUNTY.



VIEW OF GENERAL MAINTENANCE ON GRAVEL ROADWAY IN ANNE ARUNDEL COUNTY, BETWEEN OWINGS AND SOUTH RIVER.

VIEW SHOWING RELOCATION OF GRAVEL ROAD ON THE OWINGS-SOLOMON'S ISLAND ROAD, IN CALVERT COUNTY, TO IMPROVE ALIGNMENT.

GENERAL VIEW OF THE ELIMINATION OF DEAD MAN'S CURVE ON THE BALTIMORE AND WASHINGTON BOULEVARD, IN HOWARD COUNTY, LOOKING NORTH.

GENERAL VIEW OF THE ELIMINATION OF DEAD MAN'S CURVE ON THE BALTIMORE AND WASHINGTON BOULEVARD, LOOKING SOUTH.

CONCRETE ARCH BRIDGE OVER FIFTEEN-MILE CREEK, IN ALLEGANY COUNTY.

GENERAL VIEW OF MAIN STREET, ROCKVILLE, SHOWING CONCRETE STREET, WITH CURB AND GUTTER ON EACH SIDE.

St. Mary's County.

State Road Construction.

One short section of State Road was built from the Confederate Monument and extending about two miles north, between the years 1916 and 1919, of eight-inch gravel, 14 feet wide.

State Aid Construction.

The Leonardtown streets, about 1½ miles in length, were constructed under State Aid in 1916.

Maintenance.

The cost of maintenance in St. Mary's County has been uniformly light, due largely to the fact that the travel over the major portion of this system is not excessive.

There are six miles of concrete road in St. Mary's County, 8½ miles of stone macadam and 32½ miles of untreated gravel road, making a total of 47 miles. The stone macadam sections have been treated with tar every other year.

Anne Arundel County.

State Road Construction.

One contract which was to be built with Federal Aid was started between Owensville and Shady Side, a distance of over five miles. The contract was awarded for grading and the necessary culverts.

The road from Mt. Zion to Hill's Bridge, a distance of about six miles, 14 feet, of eight-inch gravel construction, was built during the period of 1916 to 1919.

A contract has also been awarded for the construction of 0.8 mile of the National Defense Highway, near Camp Parole, but work will not commence until 1920.

State Aid Construction.

There has been no State Aid construction in this portion of Anne Arundel County during the years 1916-1919.

Maintenance.

There is a total of 36 miles of State Road in this section of Anne Arundel County; about six miles of concrete, and 30 miles of

untreated gravel. Considerable resurfacing has been done during this period on the gravel road from the Tea House, north of Mt. Zion, to the Calvert County Line. The road has been straightened wherever possible, and banks cut back in order to afford a view ahead to the traveling public. The road is maintained by patrolmen, who are equipped with steel and wooden drags. The drags are at the present time being pulled by trucks, with a view to motorizing the equipment, which up to the past year, was chiefly horse-drawn.

CALVERT COUNTY.

State Road Construction.

There has been no construction work done in Calvert County during this period.

State Aid Construction.

Calvert County has not built any roads under the State Aid Act during 1916-1919.

Maintenance.

We are maintaining a gravel road 34 miles in length, running from the Anne Arundel County Line to Solomon's Island. A considerable portion of the road between Owings' Station and Prince Frederick was resurfaced in the year 1919. A great many dangerous curves were eliminated. The road was maintained by means of patrolmen who dragged their sections at frequent intervals. Much difficulty is encountered in this section to secure suitable material to patch the road.

BALTIMORE-WASHINGTON BOULEVARD.

Construction.

We constructed in 1917 and 1918 on this road 6.14 miles of concrete shoulders between Laurel and the Patapsco River, and 4.75 miles of 20-foot concrete roadway.

In Prince George's County, betwen Laurel and the District Line, we built 10.4 miles of concrete shoulders, and one-half mile of concrete roadway 20 feet wide. We replaced an existing narrow bridge with a wooden floor at the south end of the Town of Laurel, with a concrete structure of adequate width.

The dangerous section at what is known as Dead Man's Curve, about one mile south of Elkridge, was straightened out, and a new roadway constructed of concrete 20 feet wide.

Maintenance.

The maintenance of the Baltimore-Washington Boulevard in Prince George's and Howard Counties, a distance of 25 miles, was kept to a high standard by the patrol system up to the winter of 1917 and 1918, and by being treated with tar annually. The excessive travel during the early part of the year 1918, due to the war, and the estblishment of cantonments at Washington, Meade and Laurel, caused extensive and serious damage, which was remedied by the afore-mentioned concrete construction.

In order to obtain a uniform cross-section, a bituminous macadam filler was placed between the edge of the concrete shoulder and the center of the macadam.

BALTIMORE CITY RESIDENCY.

By Edwin Friese, *Resident Engineer.*

Anne Arundel County.

State Road Construction.

The following summary, with respect to Anne Arundel County, deals only with that portion north of Annapolis, and is not complete for the entire county. In this portion, there has been built under the State Road Act during the period from 1916 to 1919, inclusive, three sections of State road, aggregating 3.40 miles, of which 2.7 miles are 16-foot, seven and five-inch concrete, and 6.7 miles are 16-foot macadam. This short stretch of 16-foot macadam completed the gap in the main highway between Baltimore and Annapolis, and the 0.76 of a mile of the concrete completed the gap between Westport and Glenburnie, making it possible to ride from either Westport or Brooklyn to Annapolis continuously on a good road. The other 1.94 miles of concrete were built between Glenburnie and Benfield along the line which ultimately will form another main thoroughfare to Annapolis.

State Aid Construction.

The State Aid roads completed between the period from 1916 to 1919 in the upper portion of this county were built in nine sections,

aggregating 11.06 miles, of which there are 4.85 miles of 14-foot concrete, 1.02 miles of 15-foot concrete, 3.66 miles of 16-foot concrete and 1.53 miles of sheet asphalt, 1½ inches of binder and 1½ inches of topping, which was placed over a badly broken-up piece of Hassamite after this latter pavement had been repaired in places to act as a base for the asphalt surfacing.

Maintenance.

Under maintenance, in the upper portion of this county, there are 21.91 miles of macadam, five miles of which are tar macadam, 6.71 miles of concrete, 0.31 miles of brick, aggregating 28.93 miles of State roads. The brick section is now included in Baltimore City. These macadam roads were each treated every year of the above period with one-quarter gallon per square yard of tar, and 25 pounds per square yard of chips, with the exception of the tar macadam. There was no unusual maintenance on these sections. The Severn River Bridge is included in the maintenance in that portion of the county north of Annapolis. This bridge is an old wooden structure, which is entirely too light for the loads that are continually passing over it. A new bridge is immediately necessary as a matter of safety.

There are 3.87 miles of macadam; 10.31 miles of concrete; 0.92 of a mile of Hassamite, and 1.53 miles of sheet asphalt on Hassamite base, aggregating 16.63 miles under maintenance by the State, and which were accepted as State Aid roads. The treatment of these macadam roads is essentially the same as the treatment of State roads under maintenance. The concrete is being maintained by replacing failures of considerable size with new concrete and patching light failures and cracks with tar and chips. There is only one item of unusual maintenance in the above length of State Aid roads, and that is Hassamite. This pavement is a stretch between Wellhams and Harmans, 1.53 miles in length, which failed badly under the Government war truck traffic; in fact, so badly that it was a question of rebuild or resurface it. The latter course was followed as a course of economy and convenience. The sheet asphalt cost only about two-thirds as much as a new concrete road. It was quickly done, only requiring about one-third of the time to build. It caused traffic less inconvenience, on account of eliminating detours without any sacrifice of quality; in fact, with such repairs to the base as were made, I think we have a better pave-

ment than the ordinary concrete road. A cobble shoulder supports this asphalt, and gives three feet of extra width of hard roadway in a sandy soil, which is a considerable advantage.

Baltimore City.

Construction.

In Baltimore City, during the period from 1916 to 1919, there was considerable construction, this included the Hanover Street Bridge and its approaches, 1½ miles long. The bridge proper is a reinforced concrete one over the north branch of the Patapsco River, and is 2,290 feet long, 50 feet between curbs, with eight-foot sidewalks. The rest of the 1½ miles is sheet asphalt street construction in cut and fill, with the exception of 600 feet of reinforced concrete bridge in two sections over the south branch of the Patapsco River. During this period, the Liberty Heights Avenue Bridge, over the Western Maryland Railway was built. This structure is 40 feet between curbs, with eight-foot sidewalks, and is 154 feet long. In addition to these bridges, 9.13 miles of the highest type of sheet-asphalt city streets in 10 sections were built, With the exception of 1.92 miles of the above street, this work was done under the supervision of the late E. H. Wroe, as Resident Engineer.

The State assumes no maintenance in connection with city streets, but turns the streets over to the city as soon as they are completed. The city, however, gets 20 per cent. of the automobile license receipts after the Motor Vehicle Commissioner's expenditures are deducted. The remaining 80 per cent. is turned over to the State Roads Commission for the maintenance of State roads.

BALTIMORE COUNTY RESIDENCY.

By D. P. Campbell, *Resident Engineer.*

Baltimore County.

State Road Construction.

The State roads construction in this county during the period of 1916 to 1919, included 12.39 miles of oil-bound macadam; 7.92 miles of concrete, varying from 14 to 17 feet in width, one street 39 feet in width, and 5.97 miles of three-foot concrete shoulder, each

side of the road, with a tar-macadam backfill on each side of the road and against the shoulder. All of the above construction is completed with the exception of the York Road, from Parkton to the Maryland Line, and through Reisterstown, which will not be completed until next year. The above work covers nine sections of road all on main thoroughfares out of Baltimore City. In addition to this road work, one bridge was extensively repaired; that over the Patapsco River at the Carroll County Line, on the Westminster Pike, and another new bridge built over Western Run on the York Road.

State Aid Construction.

The State Aid construction in Baltimore County has been considerable. There have been built 16 sections of road, most of them equally important as the State road sections running out of Baltimore City. These sections are made up of 20.83 miles of concrete; 10.36 miles of macadam, and 5.71 miles of sheet asphalt, aggregating 36.9 miles.

Maintenance.

Under maintenance in Baltimore County, there are now 65.05 miles of macadam; 5.49 miles of concrete; 12.04 miles of bituminous concrete; 1.45 miles of brick; 1.45 miles of sheet asphalt, aggregating 85.49 miles of State roads.

There are also 33.21 miles of macadam; 25.10 miles of concrete, and 3.05 miles of sheet asphalt, aggregating 61.36 miles under maintenance, which were built under the State Aid Acts. Thirty miles of this macadam and concrete were turned over to the State Roads Commission for maintenance by mandamus proceedings instituted by the Baltimore County Commisioners in the Baltimore County Circuit Court last January. The macadam roads thus taken over were for the most part in bad shape, and extensive resurfacing, patching and oiling were immediately necessary. The concrete roads were patched with concrete where the failures were extensive, and in other places ordinary tar patching of small depressions and cracks was resorted to. This was all accomplished during the past working season. All macadam roads under the State supervision throughout the county have regularly been treated with a surface course of oil and chips each year, as was described under remarks for Anne Arundel County.

Harford County.

State Road Construction.

The State Roads construction work completed, and under way in Harford County during the period from 1916 to 1919, is represented by five sections of road, aggregating 16.11 miles, of which 10.38 miles are concrete, and 5.73 miles are 3-foot concrete shoulders each side of the road, with a tar-macadam backfill on the road side of the shoulder. All of the above construction is completed with the exception of the Jarrettsville-Black Horse Road, which will not be completed this year.

State Aid Construction.

There has been little State Aid construction in Harford County during the above period; in fact, only one road, which is now under construction. It is the road from Ramsey's Corner to Pylesville, a 15-foot, eight and six-inch concrete road, 2.33 miles long. It will not be completed until next year.

Maintenance.

In Harford County, under State Road maintenance, there are 48.50 miles, built as State roads, of which 43.41 miles are macadam, and 5.09 miles are concrete.

The State Aid roads, under State maintenance, are 11.86 miles in length. These roads are all macadam, and were properly repaired by Harford County Commissioners, according to the specifications of the State Roads Commission before they were turned over to the State for maintenance.

Baltimore-Washington Boulevard—In Baltimore County.

Construction.

During the period from 1916 to 1919, 2.03 miles of two-foot concrete shoulder 6 inches deep were built along the sides of the existing 16-foot concrete roadway, making 20 feet of metal surfacing. A reinforced concrete arch was also built over the Patapsco River, beween Baltimore and Howard Counties, near Elkridge.

Maintenance.

There are now 3.6 miles of roads under maintenance on this section, 2.7 miles of which are 20-foot concrete with a sheet asphalt

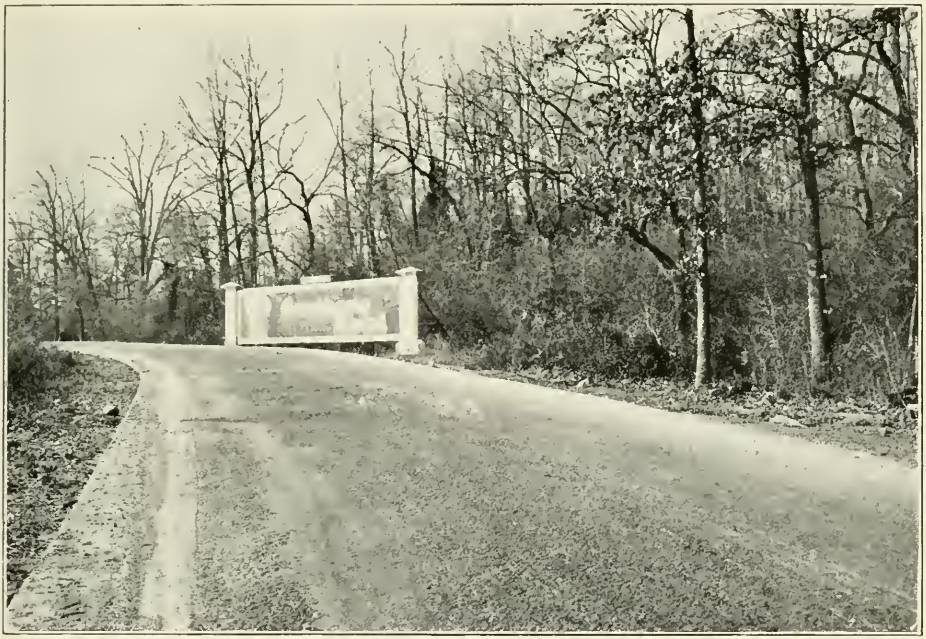
top, and 0.9 of a mile is 16-foot macadam. For a year or more, the 20-foot concrete section has been failing badly, and to save it a sheet asphalt surface, 1½ inches of binder and 1½ inches of top was placed over it with an 18 inch cobble shoulder on each side. This method especially commends itself because of its economy. The cost of this asphalt top was only one-third of that to replace the old concrete with new concrete. This type of reconstruction causes the least amount of inconvenience to the traveling public, is quickly built, and results in a better, stronger and more efficient road. This, together with the fact that maintenance is practically eliminated, still strengthens the argument that this method should be further used.

General Comments.

During the period from 1916 to 1919 a marked development in type and width of construction and maintenance has taken place. This, like all other problems of maintenance and construction, has been brought about by traffic, especially war traffic, during the years of 1917 and 1918. Several of our main highways suffered most, due to this unusually large amount of traffic of heavy tonnage. I refer especially to the lines from Laurel to Elkton, which failed badly in places under the heavy truck traffic just after the severe winter in 1916-1917. The roads were too light and too narrow, and the traffic too great in the number of vehicles and heavy tonnage.. This, together with the fact that frost had entered the sub-grade for several feet, caused failures in large numbers along the whole line above mentioned. The repair work made necessary was so heavy as to amount to about two-thirds of the maintenance cost for the entire Harford County in 1916, and about one-half the maintenance cost for the entire Baltimore County in 1916. This, in a measure, gives an idea of the damage directly due to increase in traffic during the war period. This experience brought out the fact that our roads must be widened and reinforced, due to the demands of traffic. With this point in view, our county roads have been widened from a standard of 14 feet to as much as 22 feet, and increased in thickness from seven and five inches to eight and six inches. Concrete shoulders have been built along old macadam roads in such a way as to add six feet in width to the metal in most instances, and they are placed at such elevations as to reduce excessive crown and permit the addition of road metal along the roadside of the concrete. This latter

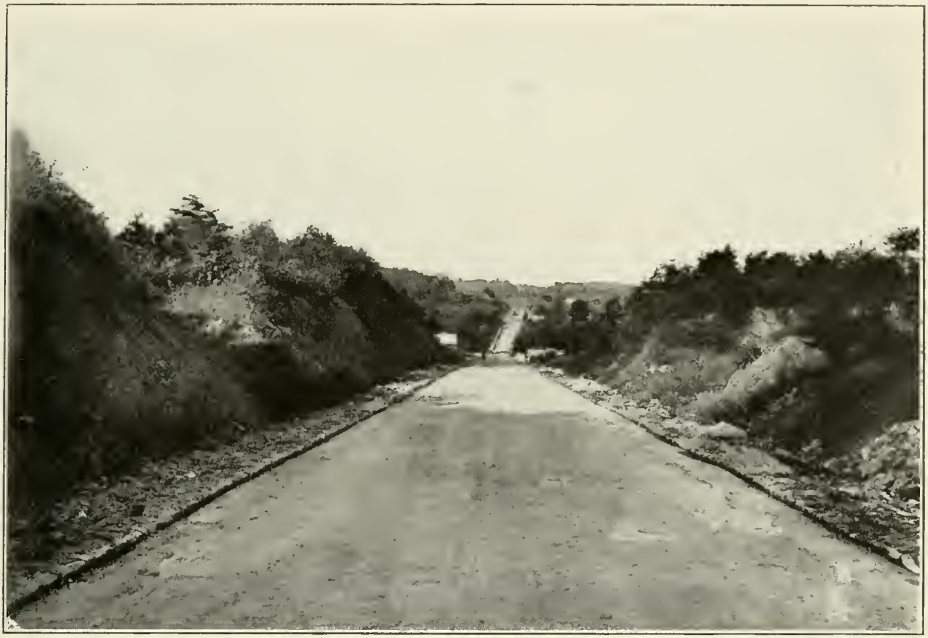
VIEW OF LAKE FANNIE HILL, SHOWING BANK CONSTRUCTED ON LEFT TO PREVENT ACCIDENTS.

VIEW SHOWING BANK ON LAKE FANNIE HILL, IN HARFORD COUNTY, GRADED TO IMPROVE VISION.



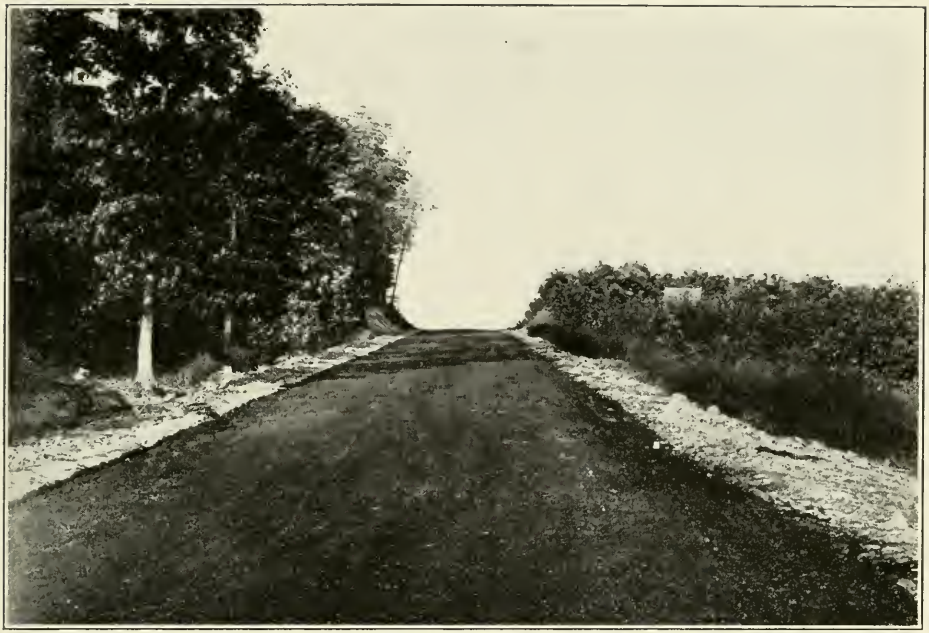
VIEW OF BELAIR ROAD IN BALTIMORE COUNTY, SHOWING CONCRETE SHOULDERS AND BANKED CURVE.

GENERAL VIEW SHOWING CONCRETE SHOULDERS ON BELAIR ROAD, IN HARFORD COUNTY. MACADAM ON LEFT NOT YET FILLED IN AGAINST SHOULDER.



VIEW OF CONCRETE BASE, WITH COBBLE SHOULDER IN PLACE ON EACH SIDE, PRIOR TO SURFACING WITH SHEET ASPHALT– BALTIMORE AND WASHINGTON BOULEVARD, IN BALTIMORE COUNTY.

FINISHED SHEET ASPHALT PAVEMENT ON THE BALTIMORE AND WASHINGTON BOULEVARD, IN BALTIMORE COUNTY.



VIEW OF BALTIMORE AND WASHINGTON BOULEVARD, IN BALTIMORE COUNTY, SHOWING BINDER COURSE IN PLACE, READY TO RECEIVE ASPHALT TOPPING.

VIEW SHOWING ASPHALT BEING DELIVERED AND SPREAD ON BALTIMORE AND WASHINGTON BOULEVARD, IN BALTIMORE COUNTY.

treatment was started about 18 months ago on the Belair Road, and up to the present has been very successful. It is further very practical, very efficient and very economical in that the concrete shoulder is easily and quickly built under traffic and permits the addition of further metal at the edge of the old road, the point where the latter is weakest and failures most frequent. It reduces the excessive crown that marked considerable of our old construction, thus causing traffic to better distribute itself and increasing the safety of travel. The method is convenient in that it permits traffic to use the road while under construction, with no more than ordinary hazard. It is further economical in that the metal itself costs little less than one-half the amount necessary to construct the metal alone in a new road of equal width, and is commendable because it takes advantage of construction already existing, on which there has been large construction and maintenance expenditure.

In some instances, as in the case of the Philadelphia Road, just outside the old limits of Baltimore City, sheet asphalt, one inch of binder and 1½ inches of top was placed on an old macadam base. This road is located in an industrial section that draws unusal heavy traffic, and while surfaced with macadam was almost impossible to keep in repair. The sheet asphalt resurfacing eliminated the maintenance cost immediately, and there has been nothing spent on this surfacing during the past three years. Again, concrete roads that have failed or were pounded to failure by traffic, especially war traffic, as was the case on the Camp Meade Road and on the Baltimore-Washington Boulevard in Baltimore County, have been surfaced with sheet asphalt and at the same time widened by addition of cobble shoulders in a most satisfactory and economical way.

All the methods just reviewed are rather ingenious, because they are both satisfactory and economical ways to take care of ever-increasing and perplexing maintenance problems by utilizing existing construction.

The maintenance throughout this territory is carried on by the patrol system, augmented by gangs wherever the work is of such extent as to require the latter. Patrol sections vary in length from three to five miles, and patrolmen are allowed helpers and teams at times. The size of the maintenance gang is controlled by the work it has to do. In special instances, such as sheet asphalt, resurfacing contracts are made to carry the work. The roads through-

out this territory are intermittently treated with light applications of tar or oil and heavy applications of chips, which are immediately rolled with a 10 ton roller. These applications have occurred yearly around Baltimore City, because a general oiling saves gang patching by the wholesale, which is more costly and not as satisfactory. We have a uniformly new surface when the road is generally oiled, which will wear better and does away with restoring of the surface in places, which causes unequal wear and gives rise to a condition of continual patching, due to the unequal resistance of the wearing surface. This is essentially what the maintenance methods are throughout the Baltimore County Residency, with such modifications as existing conditions may require.

CHESTERTOWN RESIDENCY.

By A. F. SHIVRE, *Resident Engineer.*

CECIL COUNTY.

State Road Construction.

During the past four years, 1916 to 1919, seven sections of road have been added to the State roads system, aggregating 8.5 miles. This consists of 2.1 miles of 14-foot macadam, eight inches thick, 0.6 of a mile of 15-foot macadam, eight inches thick, 4.4 miles of 15-foot concrete, five and seven inches, and 1.4 miles of 17-foot concrete, six and eight inches thick. At the close of the year 1919, there are two sections of road under construction, making a total of 2.4 miles, consisting of 0.3 of a mile of concrete construction, 17 feet wide, six and eight inches thick, and 2.1 miles of concrete construction, 15 and 18 inches wide, and six and eight inches thick, and both of these jobs are about 40 per cent. completed.

During this period, three bridges have been built on the State roads system in this county: A two-span bridge of slab construction near Bacon Hill, to replace an iron structure knocked down by traffic; a reinforced concrete arch of three spans erected across Little Elk Creek, near Elkton, to replace an old wooden structure, and a 750-foot bridge of reinforced concrete slab construction, equipped with bascule draw-span of the two-leaf design, across the Sassafras River between Cecil County and Kent County, to replace an old wooden structure.

The main line between Conowingo Bridge and the Pennsylvania State Line at Sylmar, has had 3.1 miles of roadway added to it

during this period, consisting of 1.5 miles of 15-foot concrete construction between Porters Bridge and Rising Sun, and 1.4 miles of 15-foot concrete between the old macadam surfacing, leading east from Rising Sun and the Pennsylvania State Line at Sylmar; also 0.3 of a mile of 15-foot macadam on the approach to the Conowingo Bridge, and after the completion of the 2.1 miles of concrete now under construction between Porters Bridge and Rising Sun, this line will be completed. A bridge will be necessary, however, across Conowingo Creek at Conowingo, to replace a temporary wooden structure now in use.

Three and three-tenths miles of roadway have been added to the Post Road between the Havre de Grace Bridge and the Delaware State Line, consisting of 1.6 miles of 15-foot concrete construction, both east and west of the town limits of Elkton, 0.3 of a mile of 15-foot macadam within corporate limits of Elkton, and 1.4 miles of 17-foot concrete construction between Elkton and North East, to replace the sections of gravel surfacing that were found unsuited for the traffic using this line. This leaves a gap of 0.8 of a mile in length on this line through the town of Elkton of which 0.3 of a mile is now under construction, which is to be concrete, 17 feet in width. Two new bridges are also necessary on this line, one across Principio Creek at Principio, to replace a damaged iron structure, and one is necessary across North East Creek at North East, to replace two old iron structures now unfit for use.

The link by way of Calvert, Fairhill and Singerly, which connects the Conowingo in Sylmar Line to the Post Road, has had 2.1 miles of 14-foot macadam construction added to it, thus leaving a gap 9.5 miles in length to improve before the link will be completed.

On the main line from Elkton south, new bridges are needed over Back Creek at Chesapeake City, and over the Bohemia River, to replace the present wooden structure.

State Aid Construction.

Four sections of State Aid roads, aggregating 6.5 mlies, have been built during the past four years, consisting of 0.3 miles of 14-foot concrete, five and seven inches thick, and 6.2 miles of 14-foot macadam construction, eight inches thick.

Aiken Avenue, 0.3 miles of 14-foot concrete, was built between the Post Road at Perryville and Aiken, thus filling a gap between the two points.

The Rowlandsville-Five Points Road of 14-foot macadam construction, two miles in length, connects with the main line between Conowingo and Rising Sun near Oakwood, and runs in the direction of Rowlandsville.

The two sections of the Cecilton-Warwick Road complete the link between the main line at Cecilton, and the Delaware State Line near Middletown. Both of the roads are of 14-foot macadam, 4.2 miles in length.

The Liberty Grove Road, a section of concrete surfacing 2.6 miles in length, 14 feet wide, five and seven inches thick, is now under construction, and about 95 per cent. completed. This road connects the village of Liberty Grove with the towns of Rock Run and Port Deposit.

Another section of State Aid construction was awarded in 1917, the Cowentown Road to be of penetration macadam, 2.3 miles in length, 14 feet in width, and eight inches thick. While all of the grading was done, and about 0.3 of a mile of macadam was laid, the contract was annulled on account of conditions brought on by the war, and work has not been resumed.

Maintenance.

The commission maintains 64.8 miles in this county. Eleven and four-tenths miles of this was built under State Aid, of which 6.8 miles have been built since 1916; therefore, accepted for maintenance by the commission immediately after completion as required by law. The remaining 4.6 miles of State Aid work was built prior to 1916, but recently placed in an acceptable condition by the county and accepted by the commission for maintenance. This total mileage is made up of 36.4 miles of macadam and 28.4 miles of concrete. This work is handled with a force of 10 patrolmen, supplied with single teams. Helpers are allowed in some cases, and repair gangs are organized when needed, and handled by one of the capable patrolmen. Throughout the central and lower part of the county, the earth is handled by the weekly use of drags and light two-horse road machines; but in the northern part of the county, the shoulders are kept heavily sodded and full of stone, so the dragging is not done.

During 1916, 24.7 miles of macadam surfacing was oiled in this county, but very little repair work was done other than light patching. In 1917, 15.7 miles were oiled and an effort was made to reor-

ganize the maintenance organization in the county, which owing to more or less difficulty with labor and a considerable scarcity of it, the organization had dwindled to several patrolmen only in the entire section. During the same year, considerable resurfacing was done in most every section of the county. During 1918, the maintenance organization was gotten in good working order, and the roads that were almost entirely destroyed by the army truck traffic during the spring, were repaired during the year. After this was done, 13.3 miles were oiled. In 1919, 36 miles were oiled, and an effort has been made to improve the roads generally. Drainage and shoulder work has been given considerable attention, and many weak spots and rough places in the surfacing have been removed during the year.

The maintaining of old bridges required considerable attention during 1919. The Bohemia River bridge needed repairs constantly, as well as the three bridges across the Pennsylvania Railroad tracks between Perryville and Elkton. The iron bridge at Principio across Principio Creek was badly damaged during the year, and had to be repaired, and the iron bridge at Conowingo, across Conowingo Creek, was entirely destroyed, requiring a temporary wooden structure, which is now in use.

The sections of gravel surfacing between Elkton and North East, up until the time they were replaced with concrete during the present year, was the most difficult and expensive road to maintain in the county, and the early part of 1919, in order to keep these gravel sections in good condition, the entire road was dragged daily, and constant patching was also necessary. The approach of the Conowingo Bridge was resurfaced under maintenance during 1919, and the work of eliminating the dangerous curve in front of the gravel plant of the Charlestown Sand and Stone Corporation was started, which will be completed during the coming year.

Kent County.

State Road Construction.

During the past four years, three sections of road have been built in this county, making a total of 7.1 miles. All of this is concrete construction, 15 feet in width and five and seven inches thick. At the close of the year 1919, there is one section under con-

struction, three miles of concrete surfacing, and six and eight inches thick. This contract is about 50 per cent. completed.

The main line between Galena and Chestertown, and from Chestertown to Fairlee, is now complete. Two and one-tenth miles of concrete surfacing were added to this line between Chestertown and Fairlee in 1917 and 1918, and during the same period, 1.2 miles of concrete surfacing were built within the town limits. Three and eight-tenths miles were added to the section between Fairlee and Rock Hall in 1918, and after completion of the concrete surfacing now under construction between Edesville and Rock Hall, the link between the town limits of Rock Hall and Chestertown will be completed.

There are about 1,500 feet of street to improve on Maple Avenue through Chestertown, thus connecting the Chester River Bridge with the improved surfacing on College Avenue. After this street is improved, and the erection of a new bridge across Chester River, in place of the old wooden one now in use, the main line running north and south through Kent County will be completed to the Queen Anne's County Line.

State Aid Construction.

Only one section of State Aid road has been built in this county: Two and nine-tenths miles of concrete surfacing, 14 feet in width, and five and seven inches in thickness, connecting Lambson's Station with the main line at Galena.

Maintenance.

In this county, there is a total of 31.7 miles under maintenance. Five and five-tenths miles of this were built under State Aid, of which 2.9 miles were taken over for maintenance immediately after completion, and 2.6 miles were improved by the county during 1919, and accepted by the commission for maintenance. The total mileage is made up of 18.4 miles of macadam and 13.3 miles of concrete.

During 1916, 15.8 miles were oiled; in 1917, 15.8 miles were oiled; in 1918, 15.8 miles, and in 1919, 2.6 miles. The maintenance is handled by four patrolmen, and while a part of the section is very hilly, and as the soil is light and there is considerable washing, the work is handled without difficulty by the use of drags, and with no unusual amount of patchwork.

Queen Anne's County.

State Road Construction.

No State work has been done in this county during the past four years, but at the close of the year 1919, there are two miles under construction. This is to be of concrete construction, 15 feet wide, six and eight inches thick, and will be the first construction on the proposed link between the main line at Ingleside and northeastern portion of the county in the vicinity of Sudlersville and Millington.

State Aid Construction.

Three sections of State Aid work have been built, aggregating 8.2 miles. This is made up of 7.8 miles of macadam construction, 12 feet wide and seven inches thick, and 0.4 of a mile of concrete surfacing, 14 feet wide, and five and seven inches thick. Two and eight-tenths miles of concrete surfacing, 15 feet in width, and five and seven inches in thickness, are now under construction between Church Hill and Sudlersville, which is about 80 per cent. completed.

All of the State Aid work during the past four years has been important, as Kent Island and the southwestern part of the county has been linked with the main line at Centreville, through construction of the macadam surfacing between Queenstown and Centreville, and the concrete surfacing of the Queenstown street, and on the completion of the work now under construction between Church Hill and Sudlersville, the northeastern section of the county will be linked with the main line at Church Hill.

Four bridges have been built under State Aid during the past four years, all of concrete construction: The Mason's Branch, Jarman's Run, Chester Bridge and Millington Bridge. These bridges were completed in 1916 and 1917.

Maintenance.

There are 41.2 miles under maintenance in this county; 8.7 miles of this were built under State Aid, of which 8.2 miles were accepted by the commission immediately after completion. The remaining 0.5 mile was improved by the county, and accepted by the commission for maintenance. This total mileage is made up of 34.2 miles of macadam, and 6.9 miles of concrete construction.

During 1916, 24.6 miles were oiled; in 1917, 23.5 miles; in 1918, 34.2 miles, and 1919, 30.1 miles.

The county is being taken care of by five patrolmen by using drags and small road machines in taking care of the earthwork, and while the traffic is getting much heavier, requiring considerable patching on certain sections, the work has been handled without difficulty.

TALBOT COUNTY.

State Road Construction.

Two sections of State road have been built in Talbot County during the past four years, making a total of 7.6 miles. This work consists of 5.2 miles of concrete surfacing, 14 feet in width, and five and seven inches thick, and 2.4 miles of concrete surfacing, 15 feet in width, and five and seven inches thick. At the close of the year 1919, there is one section under construction, 3.1 miles of concrete surfacing, 15 feet wide, and six and eight inches thick, and the job is about 60 per cent. completed.

The link between Easton and Trappe was completed after the construction of 5.2 miles of concrete surfacing and 2.4 miles of concrete were built on a section between Easton and Claiborne. Three and one-tenth miles are under construction on this link, leaving a gap of 10 miles to be contracted for before the link is completed.

State Aid Construction.

Four sections of road were built under State Aid, making a total of 8.6 miles, consisting of two miles of 10-foot shell surfacing, three miles of 12-foot macadam surfacing, seven inches thick, and 3.6 miles of concrete surfacing, 14 feet in width, and five and seven inches thick.

The Barber Road, two miles of shell surfacing connects with the State Road at Trappe, and runs to Barber. The Matthewstown Road, built in two sections, runs from the town limits of Easton toward Matthewstown for a distance of 4.3 miles, and the Peach Blossom Road runs from the town limits of Easton to Peach Blossom Creek, a distance of 2.3 miles.

Maintenance.

There are 36.9 miles under maintenance in Talbot County. Seven and six-tenths miles of this were built under State Aid, of which 5.3 miles were accepted by the commission for maintenance im-

GENERAL VIEW OF SASSAFRAS RIVER BRIDGE FROM SOUTH SHORE.

GENERAL VIEW OF SASSAFRAS RIVER BRIDGE, IN CECIL AND KENT COUNTIES, LOOKING SOUTH.

VIEW OF CONCRETE ROADWAY ON HANOVER PIKE, IN BALTIMORE COUNTY, NORTH OF GLEN MORRIS.

VIEW OF STREET IN REISTERSTOWN, SHOWING FINISHED CONCRETE ROADWAY, WITH COMBINATION CURB AND GUTTER ON LEFT AND STEAM SHOVEL GRADING ON RIGHT.

VIEW OF PORTERS BRIDGE—RISING SUN ROAD, IN CECIL COUNTY—SHOWING RELOCATION TO IMPROVED GRADE.

VIEW OF CONCRETE ROAD BETWEEN CHURCH HILL AND SUDLERSVILLE, IN QUEEN ANNE'S COUNTY.

mediately after construction, and 2.3 miles were repaired by the county and accepted by the commission. This total mileage consists of 16.2 miles of macadam surfacing, and 20.7 miles of concrete.

In 1916, 12.5 miles were oiled; in 1917, 15 miles; in 1918, 16.2 miles, and in 1919, 16.2 miles.

The maintenance in this county is handled with six patrolmen, and while there is one section, the Easton Point Road, originally of shell construction, but resurfaced with stone and accepted from the county for maintenance, is rather troublesome, owing to the surface being so soft, the entire county is handled without difficulty. Only light patching is needed from time to time, and the earthwork is handled by the use of drags.

Caroline County.

State Road Construction.

During the past four years, two sections of State road have been built in Caroline County, making a total of 1.9 miles, consisting of the Federalsburg streets, concrete surfacing from 18 to 22 feet in width, with combination curb and gutter and a length of 1.2 miles. Also the Greensboro streets, a section of concrete surfacing, 0.7 miles in length, 15 feet in width, and six and eight inches thick.

At the close of the year 1919, 2.6 miles of concrete surfacing, 15 feet in width, and six and eight inches thick, is under construction on the link between Bureau and Preston, by way of Grove. This job is about 50 per cent. completed. In order to complete this link, however, there remains approximately 2.5 miles to be contracted for.

On the main line by way of Goldsboro, Denton and Federalsburg, there is one gap to be completed, a section through Denton, which is about 0.8 of a mile in length.

State Aid Construction.

Four sections, making a total of 4.4 miles, have been built under State Aid, consisting of Denton streets, of concrete construction from 14 to 58 feet in width, with combination curb and gutter.

The Hynson Road, 1.5 miles of 12-foot macadam construction running from the town limits of Federalsburg toward Hynson.

The Ridgely Road, running from the town of Ridgely toward Denton for a distance of one mile. It is concrete construction, 14 feet in width, and five and seven inches thick.

The Lowe School House Road, a section of shell surfacing, nine feet in width, running from the town limits of Goldsboro toward Whitleysburg.

Two bridges have been built in this county during this period, the Smithville Bridge of concrete slab construction, and the Sandy Island Bridge, a Luten arch.

Maintenance.

This county has 47.7 miles of road under maintenance. Seven miles of this were built under State Aid, of which 3.4 miles were accepted for maintenance immediately after construction, and 3.6 miles were repaired by the county and accepted by the commission. This total mileage is made up of 24.7 miles of macadam construction, and 23 miles of concrete.

In 1916, 8.5 miles were oiled; in 1917, 10.2 miles; in 1918, 23.6 miles, and 1919, no oiling was done.

The work in this county is handled with five patrolmen. During the past two years, very heavy patching has been required, however, in the vicinity of Denton, and as the shoulders are very sandy an effort has been made to get a sod on them, which will be handled by frequent mowing.

The roads in this county suffered very heavily from several very heavy rain storms during the summer. Sections of shoulders were washed away in several places, and the entire roadway was washed out on each side of the Faulkner's Run Bridge near Federalsburg, and in the same vicinity, an eight-foot concrete bridge was destroyed. All of the filling has been done, however. Pipe was substituted for the eight-foot concrete bridge, and surfacing will be laid on the several sections washed out during the coming year.

Construction in General.

Construction work has been carried on during the past four years under conditions that have been the most trying for both the contractor and engineer since the beginning of State road construction 10 years ago. The scarcity and high cost of labor and materials were beginning to be felt in 1916 and 1917, and jobs were either closed down or carried on in a very poor way. In 1918, work was practically closed down with the exception of several very important jobs that were carried on and pushed to completion

by the co-operation of the commission with the contractors, in the furnishing of labor and materials. Credit is due both for carrying on these jobs during 1918, when the Government had taken over practically all labor and materials for the war.

While construction work started in full force during 1919, there is still more or less scarcity of labor and materials, which has caused considerable delay, and in addition to this, 1919 has been an unusually wet season, closing down construction work for a week at a time, which has been the principal cause of such slow progress on several jobs in this residency this year.

There is an improvement in the work of 1919, over the work done during former years, and every contractor in the residency is making a special effort to co-operate with inspector and engineer, in an effort to get the best work possible.

Maintenance in General.

While there has been no extensive repair work necessary on the completed roads in this residency, with the exception of Cecil County, during the past four years, the cost of the work has increased considerably, of course, on account of the 75 and 100 per cent. increase in the cost of materials and labor. While the mileage has increased about 28 per cent., there has been a very slight increase in the number of patrolmen used, and without a single exception, the work at the close of the year 1919 is in better condition than it has been since construction.

Up until the past two years, the traffic in the four lower counties has not been heavy enough to require many repairs to the surfacing, but as the soil is light and free from rock, the earthwork required constant attention, and most of this material was handled by hand, which amounted to probably 75 per cent. of the total cost of labor on repairs. During the past two years, however, the cost of earthwork repairs has been cut to a minimum, and the hand work very largely done away with, by the constant and systematic use of drags and small road machines.

On patching, the use of the large tar heater by patrolmen has amounted to a considerable saving in the expense on this work. Several years ago, the small 10-gallon heater was used by all patrolmen, and while they are still in use on jobs requiring very little patching, the 75 and 100-gallon heater is being used very extensively. This does away with the constant refilling and heating

necessary with small heaters, and the frequent handling of the storage drums and barrels.

The widening and banking of curves on completed roads is a very necessary improvement which was begun this year, also the removal of culvert walls on the inside of curves. While several bad places have been improved, the work has hardly been started, and the intentions are to do considerable work of this kind during 1920.

Storage houses are being centrally located for the storing of equipment, and for the repairing and overhauling of it during the winter season, which will prevent considerable loss in equipment, owing to having it scattered and mislaid.

SALISBURY RESIDENCY.

By P. E. BURROUGHS, *Resident Engineer.*

DORCHESTER COUNTY.

State Road Construction.

There have been built under the State Roads Act during the years 1916-1919, inclusive, six sections of road, aggregating 13.5 miles, of which seven miles are concrete, 14 feet wide, six and eight inches thick, and 6.5 miles are stone macadam, 14 feet wide and eight inches thick. In 1916, 0.7 of a mile, concrete, was built through the town of Hurlock, which formed a connecting link on the main thoroughfare down the peninsula; and the following year, 0.7 of a mile of concrete was built through East New Market, making a continuous improved road from Preston to Cambridge.

During the same period, two sections, totaling 6½ miles of stone macadam, were built from Big Mills to Linkwood, including the Big Mill Dam and bridge, thus giving an improved highway from Vienna to Cambridge, tapping the main line at Mt. Holly. During each of the years of 1917 and 1919, a section of concrete road was built along the Cambridge-Taylor's Island Road, aggregating 5½ miles.

State Aid Construction.

During the period of 1916 to 1918, four sections of shell macadam, aggregating 16.1 miles were built; the Shorters Wharf Road, nine miles, nine feet wide; the Blackwater Road, 3.0 miles, nine feet wide; the Hambrook Road, 2.2 miles, 14 feet wide; and the Nanti-

coke Road, two miles, 14 feet wide. In 1918, a two-mile section of 14-foot concrete was built from the Taylor's Island Bridge toward Cambridge. This was immediately taken over by the commission for maintenance, and became a part of the Cambridge-Taylor's Island Road. In 1918, the 2¼-mile section of bituminous concrete from Hurlock to Waddell's Corner was taken over for maintenance.

Maintenance.

A total of 68 miles of State Road is composed of 25.1 miles of concrete and bituminous concrete, 37.9 miles of stone macadam, and 4.8 miles of shell macadam. Thirty-five and three-tenths miles were oiled or surface treated in 1916; 13.9 miles in 1917; 35.7 miles in 1918, and 12.9 miles in 1919. With the exception of the surface patching of the shell macadam from East New Market to Mt. Holly, no unusual maintenance has been necessary. The roads are in good shape, and are now well taken care of by six patrolmen, who averaged about 12 miles of road each. Due to the sandy soil, a concerted effort has been made towards grassed or sodded shoulders, which lessens the earthwork, and gives a neat appearance if properly mowed about every two weeks. Several special items have been done, such as concrete shoulders and curb through the town of Brookview, and the widening of several curves in different sections of the county.

Wicomico County.

State Road Construction.

In 1917, a 2.7-mile section of 15-foot concrete road was built along the Powellville-Willards Road, which when completed will connect the town of Powellville and vicinity with the railroad and the Salisbury-Ocean City Road at Willards. The first section of concrete road has been practically completed along the Salisbury-Quantico Road. This section begins at the end of the State Aided Road near Rockawalking School, and extends toward Catch Penny for a distance of 1.5 miles.

One of the most important sections of road to through traffic and adjoining counties, was the acquisition of the right of way and the improvement of the Allen Mill Dam, with a bridge and 0.23 of a mile of 15-foot concrete roadway in 1919.

State Aid Construction.

The second section of the Jersey Road has been completed with shell macadam, and there are now under construction one mile of concrete along the Old Snow Hill Road, and one mile along the Salisbury-Nanticoke Road through Royal Oaks. The Salisbury-Mt. Herman Road (14-foot, eight-inch stone macadam), has been placed in an acceptable condition and taken over by the State.

Maintenance.

There are 5.7 miles of bituminous concrete, 17.1 miles of concrete, and 22.7 miles of stone macadam, totaling 45.5 miles of paved roads now under maintenance; 17.62 miles were oiled in 1916; 5.90 miles in 1917; 17.25 miles in 1918, and 2.15 miles in 1919.

No extensive maintenance has been necessary, and the work has been generally taken care of by the five patrolmen, except along the road leading to Ocean City, where the generally sandy condition of the shoulders requires more earthwork. Several curves have been widened with concrete aprons.

SOMERSET COUNTY.

State Road Construction.

The construction work in this county during the past four years consisted of the improvement of the Pocomoke-Westover Road; one section, 2.8 miles long, built from the New York Pacific and Northern Railroad to Costen Station in 1917; and one section, 5.2 miles long, built from Costen Station west, joining the Princess Anne-Crisfield Road near Westover in 1918-1919. This is a 14-foot road of bituminous macadam, on a concrete base with a 60-foot right of way.

State Aid Construction.

There has been no State Aid roads constructed during the last four years, neither has the county placed in condition any previously built State Aid roads for State acceptance and maintenance.

General Maintenance.

The commission is now maintaining 28.5 miles of road, divided as follows: Concrete and bituminous concrete, 20.5 miles; stone macadam, 11.3 miles, and shell macadam, 4.7 miles.

Of this mileage, there were oiled or surface treated 9.6 miles in 1916; 9.4 miles in 1917; 13.4 miles in 1918, and six miles in 1919. Other general maintenance is taken care of by the four regular patrolmen, except on the shell macadam section from Westover to Kingston, which necessitates extensive surface repairs each year. The soil is a stiff clay, and the grades very flat; and for these reasons a great deal of attention has to be paid to all side ditches, and other methods of drainage.

Worcester County.

State Road Construction.

Three sections 15 feet wide, and two sections 14 feet wide, making an aggregate total of 12.7 miles of concrete road were built during the past four years. The second section of the Pocomoke-Stockton Road, 1.5 miles of 14-foot concrete, was completed in 1917, and the same year, the first section of the Snow Hill-Stockton Road, 2.6 miles of 15-foot concrete, was completed, beginning at the corporate limits of Snow Hill and running toward Girdletree. In 1916-1917, the second section of the Pocomoke-Virginia Line Road, 3.3 miles of 14-foot concrete, was built, thereby completing an improved road down the peninsula to the Maryland-Virginia State Line.

The first section of the Berlin-Selbyville (Delaware Line) Road, 4.5 miles of 15-foot concrete, was built in 1917-1918.

One of the most important highway improvements on the Eastern Shore, and one used by motorists generally from all over the State, was the construction of a concrete and steel bridge, with approaches of one mile, over the Sinepuxent Bay, thereby linking the great State system with Ocean City, Maryland's own seashore resort.

State Aid Construction.

No new projects were taken up, but the county resurfaced the Good Will and George's Island Roads with stone macadam, and the Mile Post Road with concrete. These sections, aggregating about three miles, were taken over for future maintenance by this commission.

Maintenance.

There are now under State maintenance 66.2 miles, 29.8 of this mileage being stone macadam, and 36.4 miles being concrete. There

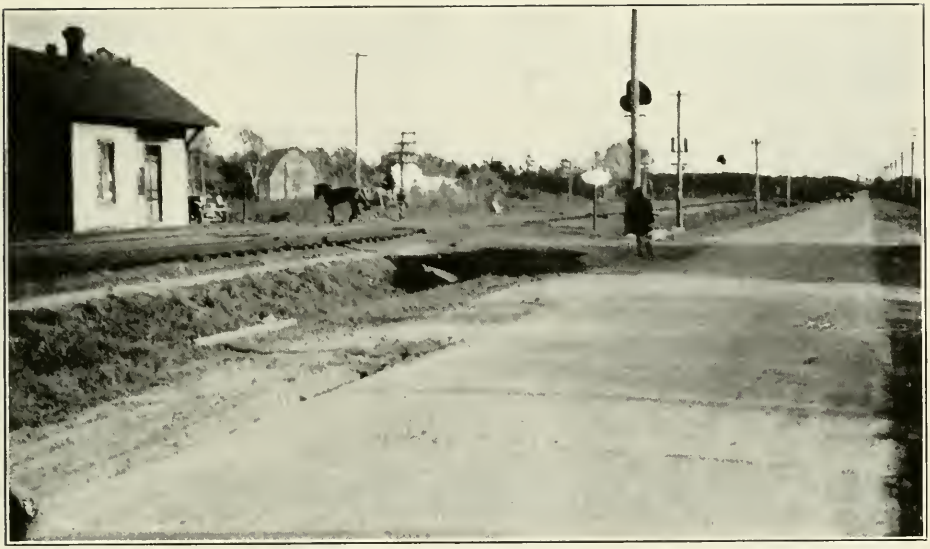
have been oiled during 1916, 1917, 1918 and 1919, 17.6, five, 17.8 and 16.9 miles, respectively.

No unusual surface repairs have been necessary. Additional earthwork was recently done on the Berlin-Snow Hill Road. Along the Salisbury-Berlin Road, the shoulders have been widened by taking advantage of the 40-foot right of way. On the Berlin-Ocean City Road, where the traffic is such as to prohibit a sodded shoulder, the sandy sections have been brought up by a clay gravel mixture, which is giving excellent results. The roads are in good repair, and with the above exceptions, are generally taken care of by seven patrolmen.

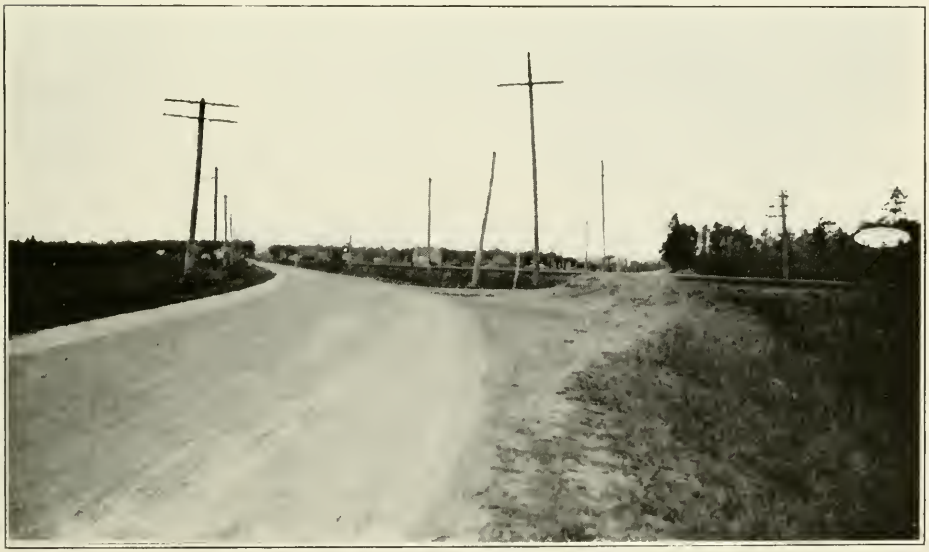
BRIDGES.

During the four years covered by this report, it has been found necessary to revise our standard plans for culverts and bridges, to take care of the increased tonnage which they have been forced to carry. Army cantonments were established at Washington, Laurel, Camp Meade and Camp Holabird, as well as at the Aberdeen Proving Grounds and the Edgewood Arsenal, and such industries as the Bethlehem Steel Company, Bartlett Hayward Co., and others at or near Baltimore, and the Atlas Powder Co., at Stump Point, increased their operations several hundred per cent., and the brunt of the enormous truck traffic resulting therefrom, was borne by the State Roads of Maryland. In addition to these war activities, freight motor lines have been established from Baltimore to Washington, Philadelphia, New York, and various points throughout Maryland, and the weight of many of these trucks when loaded, was in excess of the loads for which our early bridges were designed. For all pipe culverts, and all box culverts, having an opening of three (3) feet or less, the clear width between headwalls was increased to 28 feet, which on all box, slab and girder bridges with spans from three feet to 32 feet, the widths between walls or parapets, was made 24 feet. Standard box culverts up to 5′x5′, slab bridges with clear spans of six to 16 feet, and girder bridges with clear spans of 18 to 32 feet were re-designed to care for the maximum loads to which they would be subjected, and care was taken to get the most economical proportion of concrete and steel possible.

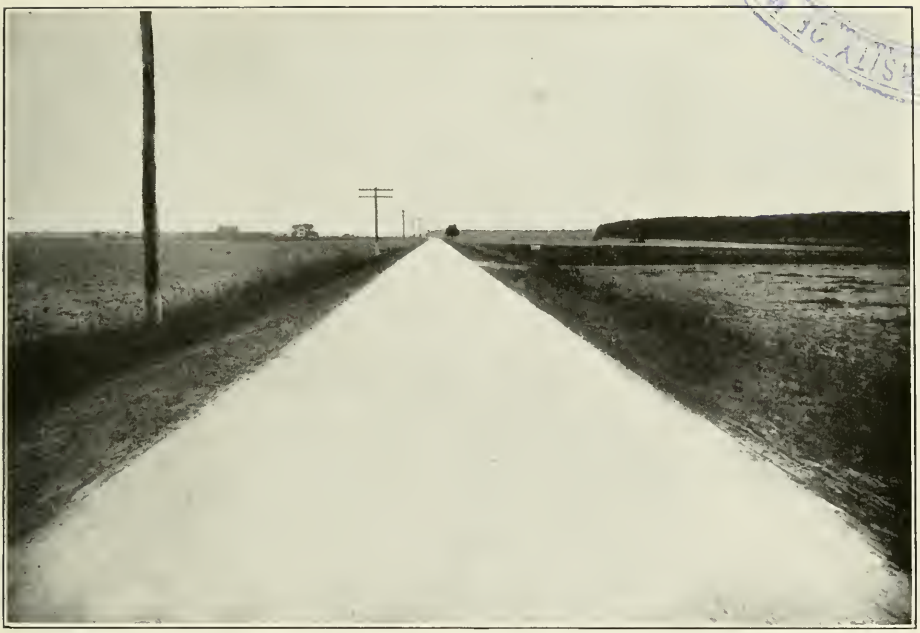
When plans are being made up for sections of proposed road, the drainage area is carefully figured by the Resident Engineer at all points where it is necessary to carry water under the road, and



GENERAL VIEW OF BITUMINOUS CONCRETE ROAD BETWEEN WESTOVER AND POCOMOKE, IN SOMERSET COUNTY.



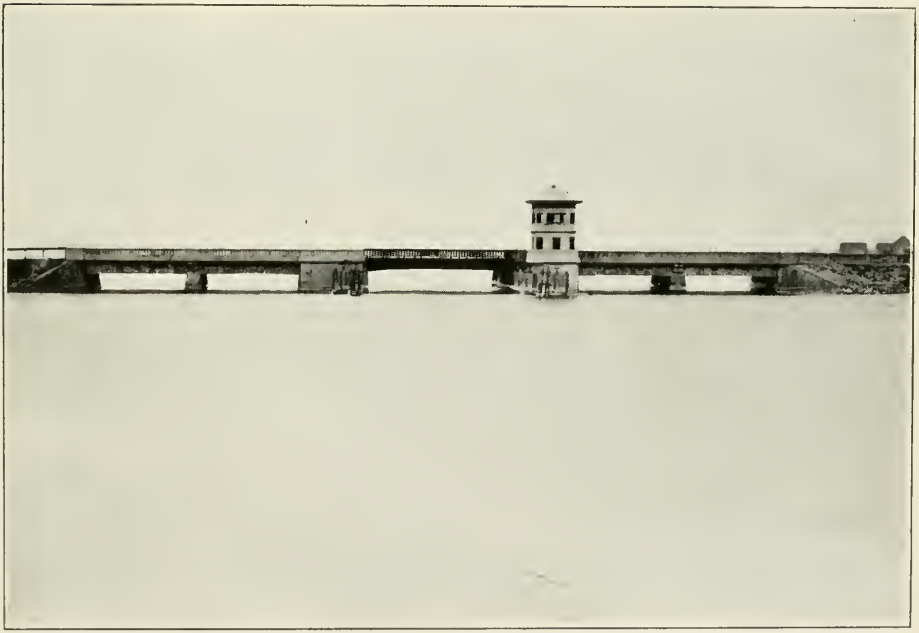
VIEW SHOWING ELIMINATION OF GRADE CROSSING ON WESTOVER-POCOMOKE ROAD, NEAR COSTEN, IN SOMERSET COUNTY.



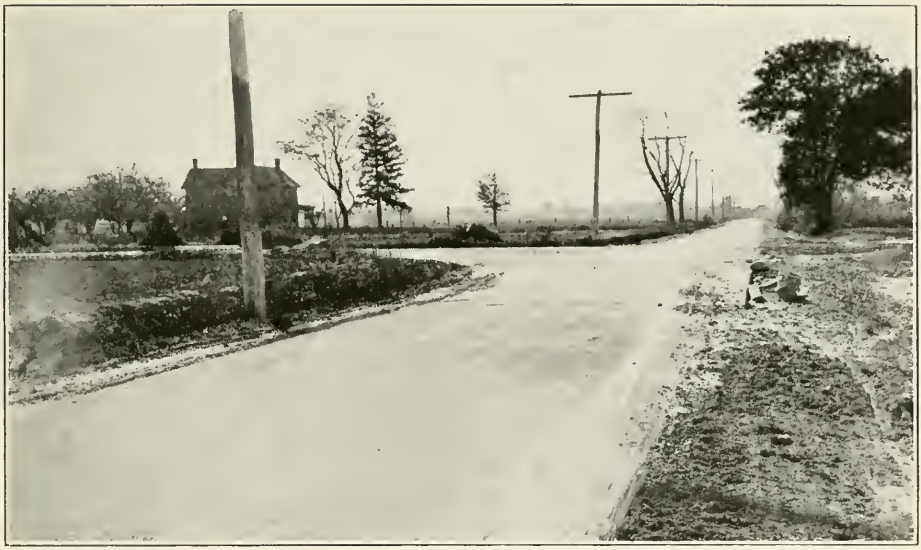
SNOW HILL-STOCKTON CONCRETE ROAD, IN WORCESTER COUNTY.

CONCRETE ROAD IN WORCESTER COUNTY, BETWEEN POCOMOKE AND THE VIRGINIA LINE.

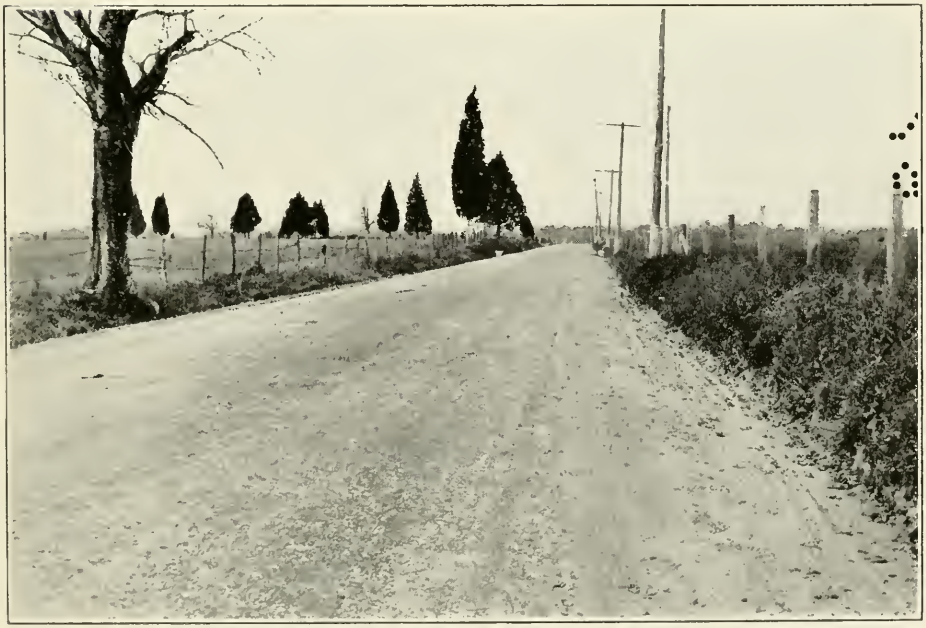
GENERAL VIEW OF CONCRETE BRIDGE AND FILL APPROACHES AT OCEAN CITY.



GENERAL VIEW OF CONCRETE BRIDGE OVER SINEPUXENT BAY AT OCEAN CITY, WORCESTER COUNTY.



JUNCTION OF BUREAU-GROVE CONCRETE ROAD WITH DENTON-FEDERALSBURG ROAD, IN CAROLINE COUNTY.



GENERAL VIEW SHOWING MAINTENANCE OF MACADAM ROAD IN TALBOT COUNTY, BETWEEN EASTON AND WYE MILLS.

this area is checked by the Engineer of Surveys. The size of opening necessary to carry the maximum volume of water which would gather on this watershed is then figured, due consideration being given to the slope of the watershed and the resulting velocity with which the water will approach the culvert. The Resident Engineeer also makes such investigations as are necessary to determine the depth of foundation required, and with this information, it is only necessary to refer to our standards to determine the culvert or bridge which will fit the conditions, and obtain the quantities of concrete and steel contained therein. Where a bridge of over 32-foot clear span is required, our standards provide for double or multiple spans, with the necessary piers and provisions for expansion and contraction of the metal. In cases where it is not practical to construct a bridge with a pier in the stream, such as mountain streams, where logs and ice would be likely to dam up the waterway, special arch or other designs are made up to fit the conditions thus presented. Where difficult foundations are encountered, test borings are made, and in deep water, test piles are often driven. In such cases, pile foundations are necessary, and the cost of construction greatly increased. Also, on navigable streams, draw spans are required, and these must conform to the regulations of the War Department. The following table shows the bridges of 25-foot span or over, which have been built during the period from 1916 to 1919, from either standard or special plans prepared by the Department of Surveys.

STATE ROADS COMMISSION.

Statement of Overhead Expenses—From May 19, 1908, to December 31, 1919.

Administration:			
Commission—Salaries and Expenses		$123,702 18	
Commission—Secretary's and Office Employees' Salaries		91,187 08	
Commission—Office Expenses		39,911 59	
Counsel Salary, Fees and Expenses		17,938 94	
Total Administration			$272,739 79
Engineering:			
General—			
Engineer's Salary and Expenses	$69,648 90		
Office Employees' Salaries	84,408 35		
Office Expenses	81,044 71		
Shop Labor, Investigations and Materials	45,767 10		
Equipment, Employees' Salaries and Expenses — and Equipment, Repairs and Supplies	51,281 14		
		$332,150 20	
Preliminary and Construction—			
Engineers' Salaries and Expenses	$54,404 17		
Resident Engineers' Salaries and Expenses	123,441 19		
Office Employees' Salaries	56,098 69		
Office Expenses	18,823 82		
		252,767 87	
Reconstruction and Maintenance—			
Engineers' Salaries and Expenses	$27,052 84		
Resident Engineers' Salaries and Expenses	110,842 78		
Office Employees' Salaries	25,708 34		
Office Expenses	17,828 54		
		181,432 50	
Total Engineering			766,350 57
Total Overhead Expenses			$1,039,090 36

Exhibit "F"

STATEMENT.

MAINTENANCE RECEIPTS AND EXPENDITURES—SHOWING DEFICIT.

By years, from 1910 to 1919, inclusive.

Years.	Receipts.				Expenditures.			Deficit.
	From Motor Vehicle Commissioner for State Roads and Bridges.	From One Cent State Tax.	Miscellaneous Sources.	Total.	Maintenance Cost.	Overhead Expenses.	Total.	
1910	$26,576 04	.....	.....	$26,576 04	$88,676 23	$24,293 25	$112,969 48	$86,393 44
1911	31,304 24	.....	$41,426 20	72,730 44	127,154 63	25,606 55	152,761 18	80,030 74
1912	74,613 76	$30,996 68	39,987 31	145,597 75	250,733 43	26,699 53	277,432 96	131,835 21
1913	116,889 42	95,301 24	37,713 81	249,904 47	341,006 27	32,486 34	373,492 61	123,588 14
1914	190,344 02	95,893 02	54,092 64	340,329 68	420,940 64	31,927 99	452,868 63	112,538 95
1915	272,883 19	117,587 34	33,001 46	423,471 99	556,232 48	32,190 73	588,422 21	164,951 22
1916	628,632 23	65,905 13	8,303 84	702,841 20	714,751 78	36,504 31	751,256 09	48,414 89
1917	1,169,133 23	4,811 05	*126,865 23	1,300,809 51	1,368,859 94	47,919 31	1,416,779 25	115,969 74
1918	†456,587 80	1,365 21	51,883 87	509,836 88	1,464,866 80	60,125 55	1,524,992 35	1,015,155 47
1919								
Total	$2,966,963 93	$411,859 67	$393,274 36	$3,772,097 96	$5,333,222 20	$317,752 56	$5,650,975 76	$1,878,877 80

*$100,000 received from the Budget.

†The money received from the Commissioner of Motor Vehicles during the months of January, February and March, 1920, must be added, due to the fact that the motor vehicle receipts for the fiscal year ending March 30 are used to take care of the Commission's maintenance requirements during the preceding calendar year, which is also the Commission's fiscal year.

STATE ROAD

RECEIPTS AND EXPENDITURES—BY FUNDS—

RECEIPTS.

	Fund.					Total.
	State Road.	State Aid Road.	Roads and Bridges.	State Road No. 1.	Federal Aid Road.	
Receipts from State Treasurer, proceeds from the sale of State Road Bonds:						
Under provisions of Ch. 141, Acts of 1908	$4,760,209 76					$4,760,209
Under provisions of Ch. 116, Acts of 1910			$991,447 55			991,447
Under provisions of Ch. 370, Acts of 1912	2,913,911 98			$196,520 63		3,110,432
Under provisions of Ch. 267, Acts of 1914	6,465,082 36			49,351 79		6,514,434
Under provisions of Ch. 681, Acts of 1916	2,720,596 71					2,720,596
Under provisions of Ch. 295, Acts of 1918	3,008,169 84					3,008,169
Total						$21,105,290
General and special appropriations:						
Under provisions of Ch. 217, Acts of 1910, and as amended by Ch. 121, Acts of 1912, for fiscal years of 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918 and 1919		$3,000,000 00				$3,000,000
Under provisions of Ch. 409, Sec. 104 and 105, Acts of 1910				†110,000 00		110,000
Under provisions of Ch. 50, Acts of 1914				15,000 00		15,000
Under provisions of Ch. 749, Acts of 1912	38,876 25					38,876
Under provisions of Ch. 394, Acts of 1912	75,000 00					75,000
Under provisions of Ch. 708, Acts of 1916	32,676 62					32,676
Under provisions of Ch. 286, Acts of 1918	85 94					85
Under provisions of Ch. 206, Acts of 1918						
Item 20B, State Budget, Miscellaneous Appropriations	100,000 00					100,000
Total						$3,371,638
Proportions of collections under Motor Vehicle Law: Ch. 207, Acts of 1910; Ch. 133, Acts of 1912; Ch. 610, 714 and 689, Acts of 1916; Ch. 206, Acts of 1918	3,207,201 59	269,233 93		300,260 48		$3,776,696
Under provisions of Ch. 375, Acts of 1912, Sec. 37A-1, for repairs and maintenance of modern State roads	417,713 30					417,713
Total						$4,194,409
Total receipts from State Treasurer						$28,671,338
Receipts from Maryland Geological Survey:						
Balance of unused appropriations with State Treasurer, under Ch. 217, Acts of 1910		97,544 81		24,052 89		$121,597

OMMISSION.

ROM MAY 19, 1908, TO DECEMBER 31, 1919.

EXPENDITURES.

	Fund.					Total.
	State Road.	State Aid Road.	Roads and Bridges.	State Road No. 1.	Federal Aid Road.	
oads and structures:						
Preliminary surveys and plans in advance of construction	$158,336 05	$55,966 30	$3,944 80	$2,478 97	.....	$220,726 12
Construction	16,493,992 59	2,450,333 83	596,314 85	458,271 92	$590,555 28	20,589,468 47
Maintenance	4,830,049 34	36,727 08	99,866 16	481,641 36	.....	5,448,283 94
Total roads and structures expenditures	$21,482,377 98	$2,543,027 21	$700,125 81	$942,392 25	$590,555 28	$26,258,478 53
verhead expenses (Exibit "F"):						
Administration, legal and engineering	$755,874 92	$227,118 06	$26,282 71	$29,814 67	.....	$1,039,090 36
otal roads and structures expenditures and verhead expenses applicable thereto, per Exhibits B," "C," "D," "E" and "F"	$22,238,252 90	$2,770,145 27	$726,408 52	$972,206 92	$590,555 28	$27,297,568 89
her expenditures:						
Payments from Motor Vehicle Tax Fund	.....	$228,422 72	.....	.....	.....	$228,422 72
United Railways and Electric Co	360,344 13	.....	6,177 22	.....	.....	366,521 35
Equipment	134,324 43	.....	.....	.....	.....	134,324 43
Interest paid on bills and accounts	15,829 86	.....	5,428 79	331 80	.....	21,590 45
Miscellaneous	4,797 56	882 19	1,036 97	814 27	.....	7,530 99
Total other expenditures	$515,295 98	$229,304 91	$12,642 98	$1,146 07	.....	$758,389 94

STATE ROAD

RECEIPTS AND EXPENDITURES—BY FUNDS—FRO

RECEIPTS.

	Fund.					Total.
	State Road.	State Aid Road.	Roads and Bridges.	State Road No. 1.	Federal Aid Road.	
Receipts from Treasurer of the United States, under provision of Act (Public 156, 64th Congress)					$590,555 28	$590,555
Receipts from other sources:						
Preliminary surveys and plans, State-aid roads		$18,009 50				$18,009
Interest on bank accts	$202,630 26		$75,049 67	$5,561 40		283,241
Discount on purchases	6,896 27	786 75	12 75	1,284 97		8,980
Sales of plans and specifications	4,170 42	737 50	109 97	40 24		5,058
Rent and tools	3,214 50		2,149 00	102 00		5,465
Permits	14,008 72		50 00			14,058
Miscellaneous	6,758 43		7 34	56 88		6,822
Total receipts from other sources						$341,636
Total receipts—all sources	$23,977,202 95	$3,386,312 49	$1,068,826 28	$702,231 28	$590,555 28	$29,725,128

Exhibit "A."

†Does not include $10,000 that reverted to State Treasurer for Baltimore City on account of Columbia A

*Composed of:

Cash in bank and with State Treasurer (shown opposite)		$1,613,205 65
Petty cash funds		50 00
Payroll cash fund		8,000 00
Paymaster's cash fund		50,000 00
Mileage books		2,442 51
Office furniture and fixtures		4,423 37
Non-collectible accounts		337 61
		$1,678,459 14
Less current liabilities:		
Conowingo Bridge bonds	$9,000 00	
Unpaid vouchers	289 69	
		9,289 69
		$1,669,169 45

COMMISSION.

MAY 19, 1908, TO DECEMBER 31, 1919—Continued.

EXPENDITURES.

	Fund.					Total.
	State Road.	State Aid Road.	Roads and Bridges.	State Road No. 1.	Federal Aid Road.	
Total expenditures	$22,753,548 88	$2,999,450 18	$739,051 50	$973,352 99	$590,555 28	$28,055,958 83
Balance unexpended	1,223,654 07	386,862 31	329,774 78	271,121 71	.....	1,669,169 45
Total	$23,977,202 95	$3,386,312 49	$1,068,826 28	$702,231 28	$590,555 28	$29,725,128 28

Cash in banks and with State Treasurer:

With State Treasurer, as of December 31, 1919	$431,775 71
With banks, as of December 31, 1919	1,181,429 94
Total	$1,613,205 65

STATE ROADS

STATE ROADS

SUMMARY OF EXPENDITURES, OBLIGATIONS, ALLOTMENTS AND

County	Expenditures.				
	Construction.				
	Preliminary in Advance of Construction.	Contract.	Other.	Maintenance.	Overhead Expenses.
1. Allegany	$4,059 44	$367,452 04	$208,423 73	$215,292 73	$33,203 49
2. Anne Arundel	8,431 81	269,583 87	117,728 11	337,360 27	30,394 11
3. Baltimore City	29,879 89	2,986,463 99	242,157 98	.....	106,258 21
4. Baltimore	6,348 09	1,081,050 78	125,657 58	664,937 96	66,504 60
5. Calvert	4,289 41	107,099 25	100,225 12	128,185 91	13,782 57
6. Caroline	3,283 46	479,227 37	64,276 84	118,429 59	22,916 85
7. Carroll	5,053 91	498,714 16	73,911 27	269,476 11	30,184 06
8. Cecil	10,295 18	633,626 56	159,337 14	273,990 87	30,930 43
9. Charles	7,099 36	317,927 77	128,480 99	162,745 73	23,483 04
10. Dorchester	5,661 67	538,266 23	132,377 37	151,049 01	27,985 61
11. Frederick	6,054 38	706,110 70	174,566 86	359,837 62	41,589 16
12. Garrett	5,962 99	485,626 32	117,080 75	204,247 88	25,725 85
13. Harford	5,512 79	506,988 49	92,040 76	355,669 76	38,836 94
14. Howard	1,782 79	287,661 38	133,802 12	230,225 83	22,582 03
15. Kent	3,413 98	398,247 21	26,973 96	81,403 77	19,254 16
16. Montgomery	4,507 25	355,338 95	345,362 20	277,033 62	33,900 68
17. Prince George's	6,272 20	441,034 05	14,778 04	189,249 71	26,642 96
18. Queen Anne's	3,526 93	387,794 48	16,666 36	140,462 30	19,489 17
19. St. Mary's	7,513 69	350,445 13	46,071 31	87,272 48	17,790 39
20. Somerset	4,774 50	392,888 56	172,091 34	58,892 13	22,848 81
21. Talbot	4,056 17	365,276 21	50,787 93	88,460 57	17,816 45
22. Washington	3,963 97	360,775 11	195,298 49	233,575 88	25,630 50
23. Wicomico	6,523 60	359,121 14	191,058 93	102,475 69	22,293 60
24. Worcester	10,068 59	515,564 40	372,553 26	99,773 92	35,831 15
Total	$158,336 05	$13,192,284 15	$3,301,708 44	$3,300,554 34	$755,874 9

*Bold figures indicate excess of Expenditures and Contract Obligations over Allotments.

Exhibit "B."

COMMISSION.

FUND.

BALANCES—BY COUNTIES—FROM MAY, 1908, TO DECEMBER 31, 1919.

Accounts of United Rwys. & Electric Co.	Total.	Allotments.	*Balance Unexpended.	*Obligations Outstanding.	*Balance Available.	County.
.....	$828,431 43	$732,306 98	**$96,124 45**	**$9,113 98**	**$87,010 47**	Allegany
$15,283 32	778,781 49	756,098 55	**22,682 94**	25,280 80	**47,963 74**	Anne Arundel
305,011 93	3,669,772 00	4,291,270 18	621,498 18	57,554 32	563,943 86	Baltimore City
40,048 88	1,984,547 89	1,889,282 87	**95,265 02**	36,577 64	**131,842 66**	Baltimore
.....	353,582 26	466,689 04	113,106 78	.....	113,106 78	Calvert
.....	688,134 11	746,858 47	58,724 36	18,517 39	40,206 97	Caroline
.....	877,339 51	871,570 84	**5,768 67**	29,790 26	**35,558 93**	Carroll
.....	1,108,180 18	1,117,457 46	9,277 28	7,655 81	1,621 47	Cecil
.....	639,736 89	714,240 82	74,503 93	33,199 22	41,304 71	Charles
.....	855,339 89	904,370 50	49,030 61	5,670 75	43,359 86	Dorchester
.....	1,288,158 72	1,209,555 02	**78,603 70**	43,519 68	**122,123 38**	Frederick
.....	838,643 79	951,879 49	113,235 70	20,238 82	92,996 88	Garrett
.....	999,048 74	864,570 36	**134,478 38**	42,256 76	**176,735 14**	Harford
.....	676,054 15	719,975 93	43,921 78	34,567 66	9,354 12	Howard
.....	529,293 08	541,889 77	12,596 69	18,346 09	**5,749 40**	Kent
.....	1,016,142 70	987,044 73	**29,097 97**	57,317 85	**86,415 82**	Montgomery
.....	677,976 96	855,282 92	177,305 96	65,599 55	111,706 41	Prince George's
.....	567,939 24	766,795 22	198,855 98	30,591 77	168,264 21	Queen Anne's
.....	509,093 00	622,582 80	113,489 80	38,441 15	75,048 65	St. Mary's
.....	651,495 34	693,487 46	41,992 12	51,477 25	**9,485 13**	Somerset
.....	526,397 33	609,773 80	83,376 47	21,715 61	61,660 86	Talbot
.....	819,244 01	840,251 98	21,007 97	27,695 41	**6,687 44**	Washington
.....	681,473 02	773,148 58	91,675 56	7,526 15	84,149 41	Wicomico
.....	1,033,791 30	1,050,819 18	17,027 88	78,862 19	**61,834 31**	Worcester
$360,344 13	$22,598,597 03	$23,977,202 95	$1,378,605 92	$743,288 15	$635,317 77	Totals

STATE ROADS

STATE AID

SUMMARY OF EXPENDITURES, OBLIGATIONS, ALLOTMENTS AND

County.	State's Expenditures.						Contracts Outstanding (State's one-half.)
	Preliminary in Advance of Construction.	Construction.	Maintenance.	Payments from Motor Vehicle Fund	Overhead Expenses.	Total.	
1. Allegany	$4,720 10	$166,178 03	$6,779 06	$24,389 26	$14,877 69	$216,944 14	$20,441 08
2. Anne Arundel	3,744 83	135,974 86	2,331 50	7,158 09	11,976 41	161,185 69	28,831 03
4. Baltimore	5,100 15	423,505 06	1,124 25	38,317 94	37,874 21	505,921 61	10,397 53
5. Calvert	428 45	.....	.....	.....	168 63	597 08	.....
6. Caroline	3,524 98	159,597 33	2,898 05	16,058 01	16,924 30	199,002 67	372 00
7. Carroll	3,524 36	164,272 23	2,783 72	8,273 86	12,932 49	191,786 66	3,356 41
8. Cecil	1,788 72	129,873 95	38 40	18,792 78	13,554 67	164,048 52	3,336 78
9. Charles	2,349 04	35,473 40	65 58	1,368 12	2,444 95	41,701 09	17,589 78
10. Dorchester	1,787 77	109,659 14	81 88	5,117 91	5,503 37	122,150 07	.....
11. Frederick	3,262 86	90,847 11	3,351 13	1,878 52	8,501 49	107,841 11	8,603 07
12. Garrett	3,569 86	39,347 31	3,146 96	.....	2,348 32	48,412 45	.....
13. Harford	1,606 18	65,501 71	353 51	21,319 21	11,301 82	100,082 43	19,837 02
14. Howard	1,648 70	82,501 45	975 46	4,184 75	6,411 25	95,721 61	15,267 62
15. Kent	1,446 09	31,044 33	91 00	2,555 62	2,537 72	37,674 76	.....
16. Montgomery	3,417 46	218,072 27	8,085 06	33,992 63	21,829 42	285,396 84	2,687 51
17. Prince George's	898 67	60,892 08	604 34	7,841 64	6,494 34	76,731 07	2,697 43
18. Queen Anne's	3,147 49	159,726 31	31 19	4,831 03	14,300 06	182,036 08	6,744 20
19. St. Mary's	385 31	5,009 72	.....	.....	590 46	5,985 49	.....
20. Somerset	536 00	25,738 52	95 59	2,008 91	2,116 15	30,495 17	.....
21. Talbot	3,150 95	139,513 95	337 40	2,902 29	11,662 14	157,566 73	.....
22. Washington	4,184 66	90,544 60	2,921 26	1,838 70	6,582 04	106,071 26	30,160 71
23. Wicomico	1,462 71	88,016 46	52 26	15,432 54	11,875 76	116,839 73	31,353 83
24. Worcester	280 96	29,044 01	579 48	10,160 91	4,310 37	44,375 73	.....
Totals	$55,966 30	$2,450,333 83	$36,727 08	$228,422 72	$227,118 06	$2,998,567 99	$201,676 00

Exhibit "C."

COMMISSION.

ROAD FUND.

BALANCES—BY COUNTIES—FROM MAY, 1908, TO DECEMBER 31, 1919.

Total Expenditures, Contract Obligations.	Allotments.			Balances Available.			County.
	Appropriations and Sundry Receipts.	Motor Vehicle Tax.	Total.	For Maintenance from Motor Vehicle Tax.	For Construction.	Total.	
$237,385 22	$212,995 96	$24,389 26	$237,385 22	.....	.....	.....	Allegany
190,016 72	182,858 63	7,158 09	190,016 72	.....	.....	.....	Anne Arundel
.....	.....	.....	.....	.....	.....	.....	.....
516,319 14	525,814 82	38,317 94	564,132 76	.....	$47,813 62	$47,813 62	Baltimore
597 08	4,720 44	.....	4,720 44	.....	4,123 36	4,123 36	Calvert
199,374 67	192,318 94	16,058 01	208,376 95	.....	9,002 28	9,002 28	Caroline
195,143 07	201,497 61	8,273 86	209,771 47	.....	14,628 40	14,628 40	Carroll
167,385 30	150,650 81	18,792 78	169,443 59	.....	2,058 29	2,058 29	Cecil
59,290 87	57,922 75	1,368 12	59,290 87	.....	.....	.....	Charles
122,150 07	127,240 66	5,117 91	132,358 57	.....	10,208 50	10,208 50	Dorchester
116,444 18	125,754 28	1,878 52	127,632 80	.....	11,188 62	11,188 62	Frederick
48,412 45	86,498 65	.....	86,498 65	.....	38,086 20	38,086 20	Garrett
119,919 45	98,600 24	21,319 21	119,919 45	.....	.....	.....	Harford
110,989 23	106,804 48	6,868 72	113,673 20	$2,683 97	.....	2,683 97	Howard
37,674 76	44,180 79	2,555 62	46,736 41	.....	9,061 65	9,061 65	Kent
288,084 35	254,091 72	33,992 63	288,084 35	.....	.....	.....	Montgomery
79,428 50	77,469 45	7,841 64	85,311 09	.....	5,882 59	5,882 59	Prince George's
188,780 28	184,591 51	4,831 03	189,422 54	.....	642 26	642 26	Queen Anne's
5,985 49	13,667 36	.....	13,667 36	.....	7,681 87	7,681 87	St. Mary's
30,495 17	35,081 22	2,008 91	37,090 13	.....	6,594 96	6,594 96	Somerset
157,566 73	160,423 30	2,902 29	163,325 59	.....	5,758 86	5,758 86	Talbot
136,231 97	134,393 27	1,838 70	136,231 97	.....	.....	.....	Washington
148,193 56	132,761 02	15,432 54	148,193 56	.....	.....	.....	Wicomico
44,375 73	44,867 89	10,160 91	55,028 80	.....	10,653 07	10,653 07	Worcester
$3,200,243 99	$3,155,205 80	$231,106 69	$3,386,312 49	$2,683 97	$183,384 53	$186,068 50	Totals

STATE ROADS COMMISSION.

ROADS AND BRIDGES FUND.

SUMMARY OF EXPENDITURES, OBLIGATIONS AND BALANCES TO DECEMBER 31, 1919.

	Preliminary Surveys in Advance of Construction.	Construction.	Account United Rwys. & Electric Co.	Maintenance.	Proportion of Overhead Expenses Applicable Thereto.	Total Roads and Structures Expenditures and Overhead Expenses Applicable Thereto.	Appropriations and Sundry Receipts.	Balance Unexpended.	Contracts Outstanding.	Net Balance Available.
1. Anne Arundel County	.....	$414,613 49	$6,177 22	$1,379 92	$15,797 89	.....	.....	.....	.....	.....
2. Severn River Bridge	.....	.....	.....	49,301 77	1,844 90	.....	.....	.....	.....	.....
3. College Creek Bridge	.....	43,702 82	.....	37,119 69	3,024 44	.....	.....	.....	.....	.....
4. Sweitzer's Bridge over Patapsco River	$3,944 80	.....	.....	.....	.....	$732,585 74	$1,068,826 28	$329,774 78	.....	.....
5. Nanticoke Bridge and Approaches	.....	72,998 54	.....	.....	2,731 66	.....	.....	.....	.....	.....
6. Conowingo Bridge	.....	65,000 00	.....	12,064 78	2,883 82	.....	.....	.....	.....	.....
7. Miscellaneous Expenditures	.....	.....	.....	.....	.....	6,465 76	.....	.....	.....	.....
Totals	$3,944 80	$596,314 85	$6,177 22	$99,866 16	$26,282 71	$739,051 50	$1,068,826 28	$329,774 78	.....	.....

Exhibit "D."

STATE ROADS COMMISSION.

STATE ROAD NO. 1 FUND.

SUMMARY OF EXPENDITURES, OBLIGATIONS AND BALANCES, MAY, 1908, TO DECEMBER 31, 1919.

	Preliminary Surveys in Advance of Construction.	Construction.	Maintenance.	Total.	Proportion of Overhead Expenses Applicable Thereto.	Total Roads and Structures Expenditures and Overhead Expenses Applicable Thereto.	Appropriations and Sundry Receipts.	*Balance Unexpended.	*Contracts Outstanding.	*Net Balance Available.
1. Baltimore City	$9 84	$18,703 10	.....	$18,712 94	$592 03	$19,304 97	.....	.....	.....	.....
2. Baltimore County	990 68	123,959 82	$82,456 13	207,406 63	6,561 77	213,968 40	.....	.....	.....	.....
3. Howard County	727 35	93,361 97	230,407 65	324,496 97	10,266 18	334,763 15	$702,231 28	**$271,121 71**	**$24,630 74**	**$295,752 45**
4. Prince George's County	751 10	222,247 03	168,777 58	391,775 71	12,394 69	404,170 40	.....	.....	.....	.....
5. Miscellaneous Expenditures	.....	.....	.....	.....	.....	1,146 07	.....	.....	.....	.....
Totals	$2,478 97	$458,271 92	$481,641 36	$942,392 25	$29,814 67	$973,352 99	$702,231 28	**$271,121 71**	**$24,630 74**	**$295,752 45**

*Bold figures indicate expenditures in excess of allotment.

Exhibit "E."

STATE ROAD BRIDGES CONSTRUCTED, 1916-1919.

Year.	Contract No.	Survey Station.	Location.	Length and Type.	Cost.
1916.....	Ho-11	121	Little Patuxent River—Ellicott City-Clarksville.....	1 22-ft. span girder	$11,934 23
		168	Little Patuxent River—Ellicott City-Clarksville.....	2 36-ft. span, 1 beam, concrete deck	
		373	Middle Patuxent River—Ellicott City-Clarksville....	1 80-ft. span, plate girders, concrete deck	
1917.....	A-13 Br.	999	Fifteen-Mile Creek—Cumberland-Washington County Line.....	1 64-ft. 10-in. span arch.....	8,697 00
1917.....	O-153 Br.	320	Zekiah Swamp—Waldorf-Bryantown.....	2 29-ft. 6-in. span girders.....	3,279 65
		327		2 16-ft. span slabs.....	
1917.....	Ch-12	179	Mattawoman Creek—Indian Head-La Plata.....	2 30-ft. span girders.....	2,351 82
1917.....	O-10-A	295	Mattawoman Creek—Indian Head-La Plata.....	2 20-ft. span girders.....	2,005 30
1917.....	F-18-A	0	Chicacomico River—Vienna-Mt. Holly.....	1 30-ft. span girder.....	2,395 77
1917.....	Wo-14	59	Owens Creek—Thurmont-Emmitsburg.....	1 30-ft. span girder.....	2,679 86
1918.....	B-21 Br.	129	Owens Creek—Thurmont-Emmitsburg.....	1 30-ft. span girder.....	2,085 22
1918.....	Ce-23	296	Pitts Creek—Pocomoke-Virginia State Line.....	2 15-ft. span slabs.....	1,705 06
1918.....	Ce-24	620	Western Run—Towson-Parkton.....	1 90-ft. span arch.....	8,858 13
1918.....	O-266	672	Little Elk Creek—Northeast-Elkton.....	1 80-ft. span arch.....	16,593 49
		574	Greish's Creek—Northeast-Elkton.....	2 60-ft. span arches.....	
		889	Sassafras River—Fredericktown-Georgetown.....	2 13-ft. 6-in. span slabs.....	1,804 39
				26 25-ft. span girders.....	*$83,285 81
				2 10-ft. span slabs.....	
				1 40-ft. span bascule.....	
1918.....	F-25	4	Flat Run—Emmitsburg-Bridgeport.....	2 23-ft. span girders.....	3,116 04
1918.....	H-17	69	Middle Creek—Emmitsburg-Bridgeport.....	2 36-ft. span girders.....	4,728 46
1918.....	K-8	132	Stirrup Run—Forest Hill-Rocks.....	1 36-ft. span girder.....	2,697 54
1919.....	Wo-12	60	Fannol's Branch—Chestertown-Fairlee.....	2 18-ft. span girders.....	2,155 73
1919.....	D-19-B	1487	Sinepuxent Bay—Berlin-Ocean City.....	4 30-ft. span girders.....	*$132,452 00
		391	Parson's Creek—Church Creek-Taylor Island.....	1 40-ft. span bascule.....	
				2 16-ft. span slabs.....	2,957 00
			Total cost.....	.....	$296,032 50

*Includes draw span.

STATE-AID BRIDGES CONSTRUCTED, 1916-1919.

Year.	Contract No.	Survey Station.	Location.	Length and Type.	Cost.
1916.....	334 Br.	0	Jarman's Branch—Centreville-Ridgely.....	3 15-ft. span slabs.....	$6,425 25
		90	Mason's Bridge—Centreville-Ridgely.....	2 36-ft. span girders.....	
1916.....	291	63	Little Youghiogheny River—Oakland-Gortner.....	2 30-ft. span girders.....	1,338 74
1916.....	102	1	Chester River—Millington-Crumpton.....	5 19-ft. 9-in. span girders.....	3,768 71
1916.....	361	141	Wootenaux Creek—Easton-Matthews.....	1 25-ft. span girder.....	1,453 76
1917.....	335 Br.	38	Cox Creek—Stevensville-Chester	2 15-ft. span slabs.....	7,588 00
1917.....	403-D	436	Gwynn's Falls—Owings Mills-Reisterstown.....	2 20-ft. span girders.....	1,288 35
1917.....	423	85	Marshy Hope Creek—Smithville-Delaware State Line.	5 27-ft. 6-in. span girders.....	7,263 98
1917.....	191	9	Patapsco River—Woodbine-Lisbon.....	1 64-ft. span arch.....	13,522 17
1918..... ..	291 Ext.	83	Little Youghiogheny River—Oakland-Mountain Lake Park.....	2 18-ft. span slabs.....	2,698 18
1919.....	473	57	Mill Creek—Annapolis-St. Margarets.....	2 29-ft. 4-in. span girders.....	7,644 90
1919..	457-A	168	Basin Run—Rock Run-Liberty Grove.....	2 25-ft. span girders.....	7,678 90
1919.....	355 Br.	1	Choptank River—Goldsboro-Delaware State Line...	2 47-ft. span arches (Luten).....	27,542 50
				2 52-ft. span arches (Luten).....	
1919.....	442	1	Red Lion Branch—Church Hill-Sudlersville.....	2 15-ft. span slabs.....	3,557 32
1919.....	453	94	Middle Patuxent River—Folly Quarter-Rolling Road.	2 30-ft. span girders.....	6,967 70
			Total cost.....	.....	$98,738 49

TOTAL COST OF BRIDGES BUILT, 1916-1919.

State Road	$296,082 50
State Aid	98,738 49
Total.....	$394,820 99

CONTRACTS AWARDED BY THE STATE ROADS COMMISSION FROM BOND ISSUE AUTHORIZED BY LEGISLATURE OF 1916.

Contract No.	County.	Name of Road.	Miles.	Surface.	Contractor.	Amount of Contract.
A-13	Allegany	National Pike	7.05	Macadam	Luck Contsruction Co.	$53,717 00
A-13 Br.	"	Bridge over Fifteen-Mile Creek			I. G. Robinson	8,780 00
					Total	$62,497 00
AA-8	Anne Arundel	Hills Bridge-Mt. Zion	6.08	Gravel	Luck Construction Co.	$44,081 68
AA-11	" "	Glenburnie-Benfield	1.94	Concrete	F. M. Duvall	21,079 96
					Total	$65,161 64
B-23	Baltimore	York Road	3.07	Resurfacing	D. M. Andrew Co.	$29,196 20
B-25	"	Liberty Road	3.00	Concrete	Fisher & Carozza	44,133 99
B-26	"	Liberty Road	3.33	Resurfacing	Atlantic Bitulithic Co.	32,529 02
B-27	"	York Road	3.56	Resurfacing	D. M. Andrew Co.	39,534 10
O-269	"	Bridge over Patapsco			G. W. Drury	1,978 00
B-28	"	Reisterstown Road	2.53	Macadam	Amiesite & Stone Co.	29,491 10
B-21 Br.	"	Western Run Bridge			B. H. Mays	9,264 50
					Total	$186,126 91
Bc-25	Baltimore City	Mount Street	0.79		American Pav. & Contr. Co.	$15,590 60
Bc-27	" "	Hilton Street	0 67		P. Flanigan & Sons	35,523 60
Bc-28	" "	Bayard Street	0.52		American Pav. & Contr. Co.	32,650 16
Bc-23	" "	Grading Pimlico Circle			Howard Firor	600 00
Bc-9 Br.	" "	Liberty Heights Avenue Bridge			L. G. Dinterman	19,167 80
Bc-9-A	" "	Liberty Heights Avenue	1.34		P. Flanigan & Sons	82,800 70
Bc-26	" "	Pennsylvania Avenue	0 27		P. Flanigan & Sons	19,129 90
					Total	$235,462 76
Co-17	Caroline	Through Preston	0.46	Concrete	Holt Construction Co.	$5,619 99
Co-11	"	Through Federalsburg	1.18	Concrete	Holt Construction Co.	20,304 55
Co-19	"	Through Greensboro	0.65	Concrete	Juniata Co.	10,161 80
O-265-A	"	Driving Piles on Dover Bridge			Dodson & Bailey	220 50
					Total	$36,306 84

CONTRACTS AWARDED BY THE STATE ROADS COMMISSION FROM BOND ISSUE AUTHORIZED BY LEGISLATURE OF 1916—Continued.

Contract No.	County.	Name of Road.	Miles.	Surface.	Contractor.	Amount of Contract.
Cl-15	Carroll	Bridgeport-Taneytown	3.15	Concrete	Thomas Mullan	$45,968 72
Cl-12	"	Westminster-Fenby	2.60	Resurfacing	Thomas, Bennett & Hunter	25,083 20
Cl-16	"	Through Sykesville	0.80	Resurfacing	Fisher & Carozza	7,549 20
O-269	"	Bridge over Patapsco			G. W. Drury	1,978 00
Cl-18	"	Littlestown Turnpike	0.50	Macadam	Thomas, Bennett & Hunter	5,251 90
					Total	$85,831 02
Ce-23	Cecil	Little Elk River Bridge			L. G. Dinterman	$14,182 40
Ce-22	"	Rising Sun—Sylmar	1.32	Concrete	E. R. Sutton	18,822 11
O-266	"	Sassafras River Bridge			R. G. Collins, Jr.	23,738 50
O-266-2	"	Sassafras River Bridge Draw			Stroble Steel Const. Co.	7,382 50
Ce-9	"	Porters Bridge-Rising Sun	3.42	Concrete	Juniata Co.	73,085 55
Ce-18	"	Through Elkton	1.63	Concrete	Juniata Co.	22,104 98
O-266	"	Piles for Sassafras River Bridge			Hoskins Lumber Co.	1,608 00
Ce-24	"	Greish's Bridge			B. H. Mays	1,885 90
					Total	$162,809 94
Ch-13	Charles	Faulkner-Wayside	5.66	Gravel	H. S. Swann	$24,886 59
Ch-12	"	Mason's Spring-Ripley	4.92	Gravel	Foundation Co. of Balto., Inc.	31,655 60
O-153 Br.	"	Bridge over Zekiah Swamp			G. W. Drury	3,204 94
O-153 Br.-2	"	Bryantown Bridge			York Bridge & Const. Co.	2,900 00
					Total	$62,647 13
D-10	Dorchester	Big Mill-Linkwood	4.39	Macadam	Phillips & Neal	$45,336 40
D-17	"	Through Hurlock	0 69	Concrete	Holt Construction Co.	8,785 00
D-10-A	"	Big Mill-Linkwood	0.20	Macadam	Whiting-Turner Const. Co.	5,676 11
D-19	"	Taylor's Island Road	2.98	Concrete	Holt Construction Co.	41,196 91
D-18	"	Through East New Market	0.72	Concrete	Phillips & Neal	10,501 73
					Total	$111,496 15
F-18-A	Frederick	Emmitsburg Pike	3.96	Resurfacing	Frank C. Gross	$46,052 94
F-18-B	"	Emmitsburg Pike	3.69	Resurfacing	L. R. Waesche	36,136 30
F-25	"	Emmitsburg-Bridgeport	3 07	Concrete	Potomac Eng. & Const. Co.	55,459 80
F-25 Ext.	"	Through Emmitsburg	0.90	Concrete	Potomac Eng. & Const. Co.	
					State	12,280 00
F-29	"	Buckeystown	2.01	Concrete	M. J. Grove Lime Co.	15,594 60
F-24	"	Through Thurmont	0.34	Concrete	L. R. Waesche	8,148 50
W-16	"	Harpers Ferry Road	3.51	Grading	R. G. Collins, Jr.	6,350 28
					Total	$180,022 42
H-17	Harford	Reese-Ramsey's Corner	4.00	Concrete	R. G. Collins, Jr.	$78,361 25
					Total	$78,361 25

CONTRACTS AWARDED BY THE STATE ROADS COMMISSION FROM BOND ISSUE AUTHORIZED BY LEGISLATURE OF 1916—Continued.

Contract No.	County.	Name of Road.	Miles.	Surface.	Contractor.	Amount of Contract.
Ho-10	Howard	Clarksville Pike	2.03	Resurfacing	Frank Carozza	$22,674 12
Ho-11 Br.	"	Clarksville Pike Bridges			Roanoke Iron & Bridge Co.	9,593 80
Ho-2	"	Snell's Bridge-Clarksville	4.67	Concrete	Claiborne-Johnston Co.	83,724 75
					Total	$115,992 67
K-8	Kent	Chestertown-Fairlee	2.13	Concrete	W. B. Shafer Co.	$25,775 20
O-266	"	Sassafras River Bridge			R. G. Collins, Jr.	23,738 50
O-266-2	"	Sassafras River Bridge Draw			Stroble Steel Const. Co.	7,382 50
O-266	"	Sassafras River Bridge Piles			Hoskins Lumber Co.	1,608 00
K-9	"	Fairlee-Edesville	3.79	Concrete	Holt Construction Co.	60,535 75
K-10	"	Through Chestertown	1.15	Concrete	Shafer & Williams	20,516 97
					Total	$139,556 92
M-13-A	Montgomery	Norbeck-Olney	1.63	Resurfacing	Chas. T. Eastburn Co.	$11,860 41
M-10	"	Clarksville Pike	5.53	Macadam	C. H. Hoyt	60,568 90
M-15	"	Dawsonville-Buck Lodge	1.70	Macadam	G. B. Mullen Co.	22,093 50
					Total	$94,522 81
P-15	Prince George's	Through Upper Marlboro	1.01	Concrete	J. W. Martin	$12,192 50
					Total	$12,192 50
S-7	Somerset	Westover-Costen	5.18	Bit. Concrete.	Ambler-Davis Co.	$79,299 16
S-9	"	Costen-Pocomoke	2.33	Bit. Concrete.	Ambler-Davis Co.	30,389 40
					Total	$109,688 56
O-265-A	Talbot	Driving Piles for Dover Bridge			Dodson & Bailey	$220 50
T-9	"	Stumptown-Trappe	5.19	Concrete	Juniata Co.	62,861 86
T-10	"	Easton-Miles River	2.47	Concrete	Juniata Co.	29,193 13
					Total	$92,275 49
O-215 Br.	Washington	Repairs to Conococheague Bridge			L. G. Dinterman	$1,085 00
W-16	Washington and Frederick	Harpers Ferry Road	3.51	Grading	R. G. Collins, Jr.	25,401 12
					Total	$26,486 12
Wi-10	Wicomico	Willards-Powellsville	2.68	Concrete	Burgess & Dorrier	$38,293 60
					Total	$38,293 60
Wo-14	Worcester	Pocomoke-Virginia State Line	3.26	Concrete	Major Construction Co.	$44,360 02
Wo-13	"	Berlin-Selbyville	5.14	Concrete	Peninsula Construction Co.	72,298 60
Wo-16	"	Fill over Sinepuxent Bay			F. B. Beasman & Co.	20,809 00
Wo-15	"	Snow Hill-Stockton	2.58	Concrete	Major Construction Co.	35,902 56
Wo-12-2	"	Draw over Sinepuxent Bay			Stroble Steel Const. Co.	15,065 00
Wo-12	"	Ocean City Draw			S. R. C.	20,000 09
					Total	$208,435 18
		Totals	146.68			$2,104,166 91

CONTRACTS AWARDED BY THE STATE ROADS COMMISSION FROM BOND ISSUE AUTHORIZED BY THE LEGISLATURE OF 1918, AS OF JANUARY 1, 1920.

County.	Contract No.	Miles.	Name of Road.	Character of Construction.	Name of Contractor.	Amount of Contract.
Allegany	A-14	2.33	Corriganville-Ellerslie	15 ft. concrete	Vang Construction Co	$86,868 78
	A-17	1.02	Cumberland-Amcelle	18 ft. concrete	R. G. Collins, Jr	117,000 00
Anne Arundel	AA-12	0.75	Annapolis Water Works-Priests Br.	16 ft. concrete	F. M. Duvall	32,263 80
	AA-15	5.59	Owensville-Shadyside	Grading and drainage	Thomas Mullan	45,542 80
	AA-16	0.59	Benfield-Severn Cross Roads	15 ft. concrete	Christhilf & Ensey	33.751 50
Baltimore	B-30	2.03	Parkton, north	15 ft. concrete	Timothy Bresnan & Son	64,911 80
	B-31	2.00	Glen Morris-Woodensburg	15 ft. and 16 ft. concrete	Fisher & Carozza Bros. Co	50,311 20
	B-34	0.76	Through Reisterstown	39 ft. concrete	American Paving & Con. Co	52,917 80
Baltimore City	Bc-29-A	1.18	Monroe St. (Eagle-Mosher Sts.)	Asphalt	Union Paving Co	100,622 45
	Bc-30		Grading Ferry Bar	Grading	Howard Firor	15,960 00
	Bc-31	0.74	Liberty Road Shoulders	3 ft. concrete shoulders	D. C. McAleer	9,917 75
Caroline	Co-18	2.60	Grove-Bureau	15 ft. concrete	Peninsula Construction Co	79,455 77
	Co-19	0.65	Through Greensboro	15 ft. concrete	Juniata Co	17,995 46
Carroll	Cl-14	1.00	Westminster, twd. New Windsor	15 ft. concrete	Thomas, Bennett & Hunter	33,529 45
	Cl-20	2.01	Westminster, twd. Union Mills	16 ft. concrete	Thomas, Bennett & Hunter	53,644 00
	Cl-23	2.00	Cl-20, twd. Union Mills	16 ft. concrete	Thomas, Bennett & Hunter	57,751 50
Cecil	Ce-26	1.36	Northeast-Elkton	17 ft. concrete	E. Ward Brown	36,608 00
	Ce-26-A	0.33	Through Elkton	17 ft. concrete	E. Ward Brown	13,987 50
	Ce-28	2.08	End of Ce-9-Rising Sun	15 ft. concrete	Thomas Mullan	58,142 85
Charles	Ch-15	3.00	Hughesville-Benedict	14 ft. gravel	R. D. Wills	38,892 90
	Ch-16	2.02	Lothair-Allen Fresh	14 ft. gravel	R. D. Wills	21,569 30
Dorchester	D-19-B	2.15	Madison-Parsons Creek	14 ft. concrete	Holt Construction Co	59,978 73
Frederick	F-27	1.79	Monocacy River Br., twd. Hopeland	Grading and drainage	M. J. Grove Lime Co	24,295 45
	F-30	1.86	Emmitsburg-Bridgeport	15 ft. concrete	Potomac Engrg. & Con. Co	65,088 00
	F-31	2.00	F-29-Lickville	15 ft. concrete	M. J. Grove Lime Co	55,182 30
	W-16-A	0.70	Knoxville-Harpers Ferry	15 ft. concrete	Fisher & Carozza Bros. Co	17,755 88
Garrett	G-13	2.12	Oakland-Hutton	15 ft. concrete	Claiborne-Johnston & Co	73,337 52
Harford	H-17-Ext.	1.38	Reese-Ramseys Corner	15 ft. concrete	R. G. Collins, Jr	29,658 20
	H-22	1.33	Through Aberdeen	17 ft. concrete	G. R. Abbott	45,557 52
	H-23	2.60	Jarrettsville-Bethel Church	15 ft. concrete	D. M. Andrews Contrg. Co	64,271 70
	H-24	0.78	H-17-A-Pylesville	15 ft. concrete	W. B. McElwain	21,571 07

Howard	Ho-8	1.18	Highland-Clarksville	15 ft. concrete	Claiborne-Johnston & Co.	$52,422 50
	Ho-12	2.51	Highland-Clarksville	15 ft. concrete	Claiborne-Johnston & Co.	88,944 50
Kent	K-12	3.03	Rock Hall-Edesville	15 ft. concrete	Kaufman Construction Co.	76,321 05
Montgomery	M-16	2.02	Bealsville-Dickerson	15 ft. concrete	M. J. Grove Lime Co.	83,468 20
	M-17	1.76	Through Rockville	16 ft. to 40 ft. concrete	Fisher & Carozza Bros. Co.	19,131 40
Prince George's	P-16	1.63	Bladensburg, twd. Lanham	16 ft. concrete	Piel Construction Co.	51,928 79
	P-16-A	0.91	P-16, twd. Lanham	16 ft. concrete	Piel Construction Co.	24,013 50
	P-17	1.48	Largo-Western Branch	15 ft. concrete	Piel Construction Co.	50,369 19
	P-17-A	0.83	Western Branch, twd. Hall Station.	15 ft. concrete	Joseph Diauto	34,606 00
Queen Anne's	Q-13	2.00	Ingleside-Millington	15 ft. concrete	Farmer & Flick	55,621 40
St. Mary's	SM-12	5.85	Great Mills-Millstone	14 ft. gravel	Thomas Mullan	69,893 00
Somerset	S-11		Pocomoke River Bridge		Fisher & Carozza Bros. Co.	33,576 50
	S-11-A		Pocomoke River Bridge Draw		Strobel Steel Construction Co.	13,221 00
Talbot	T-11	3.11	St. Michaels-Claiborne	15 ft. concrete	Farmer & Flick	90,987 00
Washington	W-16-A	2.81	Knoxville-Harpers Ferry	15 ft. concrete	Fisher & Carozza Bros. Co.	71,021 95
	W-17	2.01	Boonsboro-Keedysville	14 ft. asphalt	P. Flanigan & Sons	59,188 70
Wicomico	O-94-A	0.23	Allen Mill Dam	15 ft. concrete	Aetna Construction Co.	8,854 00
	Wi-13	1.53	Salisbury-Quantico	15 ft. concrete	Aetna Construction Co.	49,719 10
Worcester	Wo-19	1.90	Snow Hill-Girdletree	15 ft. concrete	Joseph Diauto	55,892 80
	S-11		Pocomoke River Bridge		Fisher & Carozza Bros. Co.	33,576 50
	S-11-A		Pocomoke River Bridge Draw		Strobel Steel Construction Co.	13,221 00
Elkton-Washington Road:						
Baltimore and Harford Cos.	B-32 & H-19	22.38	Belair Road Shoulders	3 ft. concrete shoulders	American Paving & Con. Co.	163,415 85
Howard Co.	BWY	15.47	Baltimore & Washington Blvd.	3 ft. con. shldrs. & 20 ft rd.	Thomas, Bennett & Hunter	215,863 60
Pr. George's Co.	BWZ	22.37	Baltimore & Washington Blvd.	3 ft. con. shldrs. & 20 ft rd.	Fisher & Carozza Bros. Co.	176,390 81
Totals		143.84				$3,069,989 32